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Volume 62 Part 4

QUEENSLAND AGRICULTURAL JOURNAL

Edited by
J. F. F. REID
Associate Editor
C. W. WINDERS, B.Sc.Agr.

APRIL, 1946

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MINISTER FOR AGRICULTURE AND STOCK

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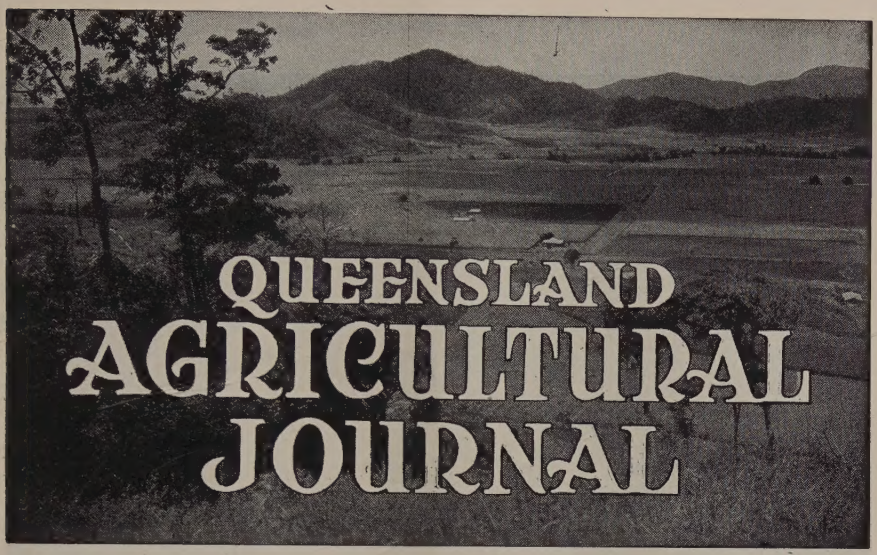

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Event and Comment.

The Right Use of Land.

WHILE there was not a great area of agricultural land still unoccupied in Queensland, he realized that there was much which could be put to better use, said the Minister for Agriculture and Stock (Hon. H. H. Collins) when opening the recent Bundaberg conference of the Queensland Society of Sugarcane Technologists.

Such organizations as that established by the technologists, Mr. Collins continued, were invaluable in determining the best use to which land could be assigned. They had set high standards in both field and factory and had increased benefits to all engaged in the sugar industry by raising production, income, and the level of employment. Increased production had successfully countered the challenge of diminishing prices. He stressed the need for further efficiency in agriculture and urged farmers to use their available arable areas to even greater advantage. It was the right use of land with which they were all concerned.

Mr. Collins added that it was especially pleasing to him as a Minister and as a farmer to see the way the canegrowers and technologists were working together so effectively in the interests of their industry. Farmers were realizing more and more the benefits to be derived from the application of scientific methods, especially in respect of plant breeding and protection and the maintenance of soil fertility. Conservation must become the core of agriculture. The scientist was collaborating with the farmer in finding the answers to rural problems and the results already achieved had added greatly to the general prosperity of the State.

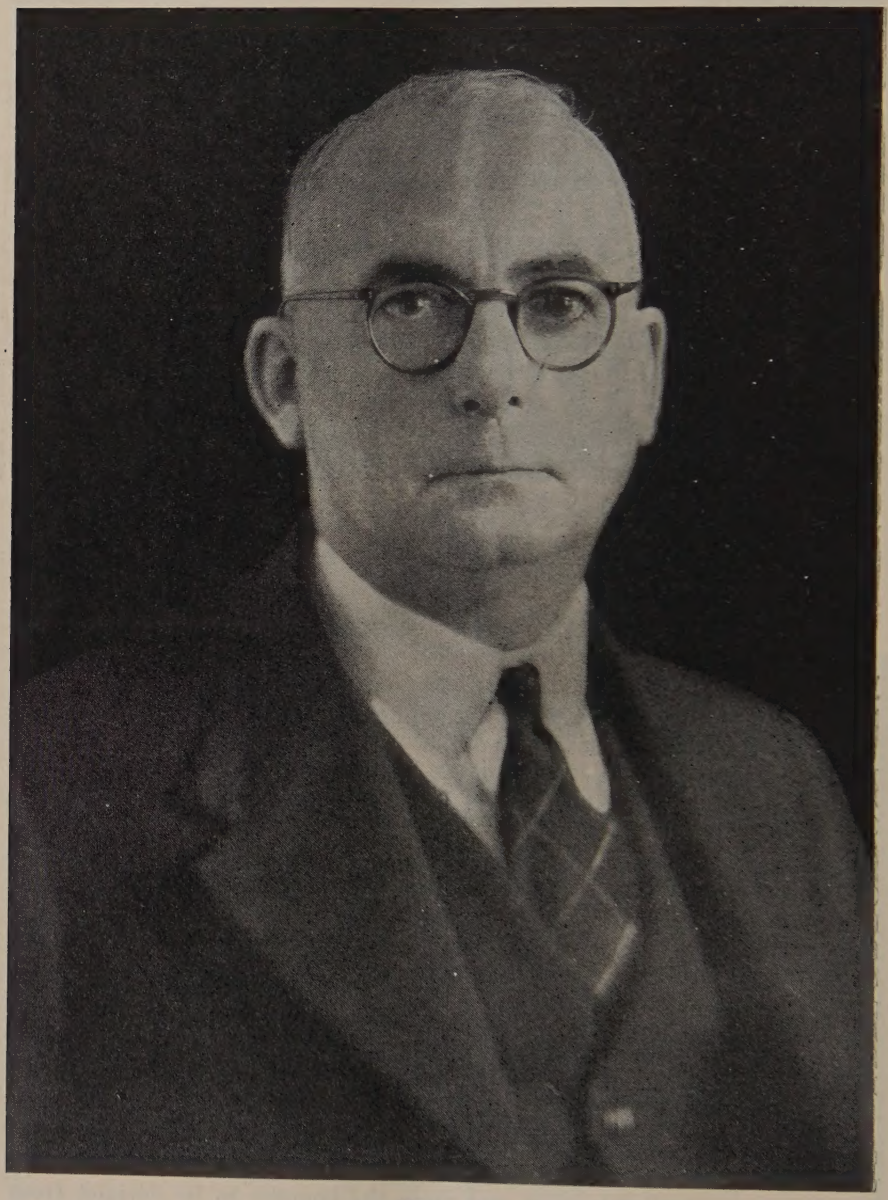

Plate 64.

The Hon. H. H. COLLINS.
Minister for Agriculture and Stock.

«» The HON. H. H. COLLINS «»
Minister for Agriculture and Stock

The Hon. H. H. Collins, who represents the Electorate of Cook in the Legislative Assembly, has been appointed Secretary for Agriculture and Stock in succession to the Hon. T. L. Williams who has taken over the portfolio of Secretary for Public Instruction.

Mr. Collins was born in Victoria and came to Queensland in 1909. For a number of years he was engaged in the pastoral industry and was for a time shed overseer with the Federal Shearing Company.

Attracted to the fertile country in the Far North, then still in the pioneering stage, Mr. Collins started farming on the Atherton Tableland in 1913. He associated himself with all progressive movements in the rapidly developing district and was elected a member of the Tinaroo Shire Council (afterwards the Atherton Shire Council). Among other public activities, he became President of the Atherton Show Society, a foundation member and Chairman of the Atherton Maize Board, a member of the North Queensland Bacon Company, and a foundation member of the North Queensland Pig Industry Board.

In 1935, Mr. Collins was chosen by a large majority as member for Cook in the Queensland Parliament and has since retained that seat by increasing majorities. He is known throughout the State, in the North particularly, as a practical farmer who has specialized with success in dairying, pig raising, and maize growing.

Mr. Collins brings to his office of Minister for Agriculture and Stock a wealth of experience in rural industries and a wide knowledge of farming practice and animal husbandry. As a student of agricultural economics, he is a strong supporter of the co-operative idea based on the principle that a country cannot thrive without prosperous primary industries as exemplified by better farming, better marketing, and better living.

Conditioning, Bulking and Grading Flue-cured Tobacco.

A. HAMILTON, Senior Adviser in Agriculture.

Conditioning.

WHEN the cure has been completed and the barn cooled down, the leaf will be dry and very brittle. In this state it cannot be handled without risk of damage; consequently, it must be permitted to absorb moisture from either the air or an artificially moistened atmosphere.

Usually when the door and ventilators of the barn are left open during the whole or part of the night, sufficient moisture will have been absorbed by the leaf to bring it into order for bulking. Should, however, weather conditions be particularly dry, with insufficient humidity to order the leaf, artificial means will be found necessary. Where the latter conditions obtain, the barn should be tightly closed down and steam at low pressure introduced into the barn. Damping of walls and placing of wet bags on the floor of the barn will also assist to create a humid atmosphere.

Whichever method of conditioning is employed great care should be taken to see that the tobacco does not absorb too much moisture. The leaves on the sticks of the lower tiers in the barn will come into condition first, and should be removed from the barn as soon as they are ready.

One point worth remembering, especially where steam is used in the conditioning of the leaf, is that with steaming there is often a "false" conditioning of the leaf. This is brought about by a too rapid introduction of steam into the barn, which does not allow of absorption of moisture by the leaf but rather causes the moisture to collect on the leaf surface. This collected moisture quickly evaporates on exposure, leaving the leaf harsh and brittle and liable to considerable damage when handled.

Where tobacco is grown on an extensive scale, the provision of a conditioning room in which atmospheric humidity can be controlled by artificial means would very materially assist in the proper conditioning of the leaf without delaying the availability of barn space. With the provision of such a conditioning room, it would be necessary to first render the leaf in the barn pliable enough to permit of its transference from the barn to the conditioning room.

Experience and judgment are necessary to determine the correct condition of the leaf for bulking down. The whole of the web of the leaf should be pliable and approximately half of the mid-rib from the tip should be supple, but showing a break before bending at right angles. The leaf may be either removed from the sticks straight away or bulked down on the sticks to await a more convenient time for its removal. In

the latter case, care should be taken that the leaves lie evenly and that sticks are so placed that alternate sticks lie with the butts of the leaves outward. Care should be exercised when bulking down sticks that the tobacco leaf does not come into direct contact with the floor, and this can be accomplished by bulking down on bags, matting, or other suitable material. Should the bulked sticks have to remain for some hours in the bulk, a covering of bags should be placed over the bulk. This will assist to even the condition throughout the bulk.

Bulking.

The bulking of the leaf should be done as soon as practicable after the leaf has been brought into condition.

In removing the leaves from the sticks a sharp watch should be kept for "fatty stems" or leaves showing the midrib insufficiently dried out. The inclusion of any such "fatty stems" in the bulks will provide a very potent source of mould development in the bulks, which can in time cause much valuable leaf to become worthless.

During the period the leaf is in the bulk certain important changes occur which affect colour, aroma, and general smoking qualities, and it is most important that every endeavour be made to retain these qualities by close attention to both the condition of the leaf and the methods employed in bulking down.

Here it is worth remarking that the fine flue-cured type of leaf can be bulked down with slightly less condition than leaf showing a greenish cast and the heavier bodied mahogany types of leaf.

Perhaps the best method of bulking is on specially built racks of a convenient length, raised about 1 foot from the floor and roughly 4 ft. 6 in. wide. An added advantage would be the provision of a boarded covering which would slide down on to the top of the bulk and upon which the necessary weights could be placed. A number of such racks placed in series in the bulk shed would permit of a number of smaller bulks which could be easily and frequently inspected, and would allow the turning of any or all bulks should the necessity to do so arise.

It is necessary to stress the need for bulking the crop down as it is harvested from the plant. To every tobacco grower with experience of the crop, there is a considerable degree of difference in quality of leaf harvested from various parts of the plant. To mix these leaves of varying body and texture in the final grading and marketing of the crop is to very seriously lower its average value. It is obvious that mixing of different grades of leaf leaves the appraiser no choice but to value the sample not on the average grade, but on the lowest grade leaf showing in the sample.

In bulking the crop down, perhaps much can be gained by the grower if he follows the practice of bulking each barn separately. This method would overcome very largely the mixing of, say, lower lug leaf with heavier bodied leaf from the higher portions of the plant. Top leaves would be kept separate from middle leaves and so on. By so doing, a much better check can be kept by growers on the quality of their crops and so overcome to some degree the suspicions held by some that they are not receiving the full value for their leaf.

Grading.

As manufacturers require uniformity in the lots of tobacco they purchase, it is to the advantage of the grower to see that his crop is presented for sale in uniform grades. To accomplish this as nearly as it

is practicable to do so, grading or sorting of the various leaf qualities found in any tobacco crop should correspond to their position on the plant. Where a crop has been bulked down with leaf corresponding to the position it occupied on the plant or in barn lots, the sorting or grading of each bulk will resolve itself into a matter of colour and length, taking care to eliminate all green leaf from the grades and making separate grades of damaged leaf.

Sorting.

Tobacco should be in proper "order" or condition for sorting. If in too dry "order" the tobacco will be injured through breakage while being sorted, as it is necessary that each leaf should be opened and inspected before being placed in its grade. On the other hand, tobacco in too high "order," or carrying too much moisture, will suffer discolouration and bruising, particularly with the fine, light-coloured leaf. Where this latter condition is allowed to arise a decrease in the value of the tobacco is the result.

Tobacco is in the correct order for sorting when just enough moisture has been absorbed to make the leaves pliable, and when they can be readily opened for inspection without breaking.

The sorting of tobacco for its presentation for appraisement is one of the most important operations, and one which generally does not receive the care and attention that is its due. By careful sorting and proper handling a crop of comparatively poor quality will show to better advantage than when haphazard methods and mixing of leaf quality have been employed to cover up the general poor quality of the crop. Equally, a crop of good quality can be greatly lowered in overall value by careless sorting and handling.

The main object in sorting is to present the crop in lots showing leaf of similar quality, colour, and length, and the presentation of each different lot separately, tied in hands, baled, and branded according to grade.

A method which should assist with the sorting of the leaf in each bulk, and one that would save time, is for the grower when bulking down a barn to select a dozen or more sticks representative of the leaf quality, colours, and length of leaf in the particular barn. These sticks could be left until last, roughly sorted into the various grades, and bulked down on top of the bulk. These graded sticks would represent roughly the grades in that particular barn or bulk and could be used as a guide in the subsequent sorting and grading of that barn or bulk.

Variation of Leaf Quality.

In the harvesting, curing and bulking down of the crop as it comes from the plant, or where the crop is bulked down in barn lots, it is inevitable that leaf quality will vary in the bulks. For instance, with lug leaves some individual plants in the crop will, through one cause or another, be "primed" higher than others, or where uneven ripening of the crop has occurred some lug leaves will be bulked with middle or "cutter" leaves. Most growers should be in a position through close contact with their crop to know the relative degree of variation of leaf quality that will be found in their bulks. With bulks of the first cures, which should consist of "lug" leaves, there will generally be two qualities of "lugs"—(1) the sand leaves showing leaf of dingy colour, thin to papery in body and generally with a percentage of injury characteristic of leaves grown near the ground (these leaves generally carry a noticeable

amount of sand, which should be shaken from the leaves); (2) better quality "lug" leaves showing good, even colour, free of injury and showing some body. With "lug" leaves the grades in this division of leaf quality will be largely governed by colour, as colour will determine body in each grade.

The next division of leaf quality—the "cutters"—will be harvested in the third cure. Some "cutters" may be harvested during the second cure and some with the fourth cure, depending on seasonal conditions, the number of leaves harvested at each curing, and other factors. "Cutters" are generally larger than "lug" leaves, free from injury, more even in colour, fine textured, and of medium body. The colour range in this division of leaf quality will vary from lemon to orange, the lemon being of less body than the orange. Here care must be taken to sort carefully according to quality and colour.

The third division of leaf quality, which will comprise all leaf harvested above the "cutters" from approximately the fourth curing onwards, will consist of heavier bodied leaf, usually narrow and more pointed than the "cutters." The leaf in this division will vary considerably in length in individual plants, and the top leaves will be the shortest leaves harvested. The colour range will vary from bright mahogany to mahogany and dark and may show some injury. The leaf generally will be coarser in texture than leaf in the other divisions of leaf quality with from medium to heavy body, and care should be taken in sorting this leaf to avoid the mixing of grades in this division.

Proper Presentation for Appraisal.

In the sorting and grading of the leaf in each division of leaf quality, it will pay the grower to see that each lot is properly presented in neatly tied hands, properly conditioned and neatly baled. The hands should not exceed 15 to 20 leaves, the lesser number in the larger and heavier bodied leaf, and each hand tied neatly with a leaf of the same grade as the hand.

The bulking down of the various lots in hands has much to commend it, but all such "handed" bulks should be well and securely covered and marked according to their respective grade.

In baling excessive pressure is not desirable; particularly is this so with the fine, bright coloured grades of leaf. Particular care and judgment must also be exercised in baling to see that the leaf is not in too high condition. In this connection, it is perhaps better to have leaf slightly under-conditioned, especially where leaf has to travel long distances, as is the case in Queensland.

In conclusion, it should be remembered that from seed beds to the bulking down of the crop months of labour and much capital are expended, but without the skilful and thorough care of the crop through its various stages of growth, the curing, bulking, and grading much labour and capital will have been expended in vain. Unfortunately, seasonal conditions always exert a powerful influence upon both quality and yield of tobacco in Queensland, but, as leaf quality is the criterion upon which tobacco is valued or appraised, it is to growers' interest to make every endeavour to present their crop properly graded according to the quality of that particular crop.

From the manufacturer's viewpoint, the individual merit of each lot submitted is of more importance than the marked grade, for the merit of each lot will determine to the manufacturer the leaf quality of the lot and its value to him in manufacture.

Papaw Culture in Queensland.

G. W. J. AGNEW, Horticulture Branch.

PAPAWS grow best in the wet tropics, where the high temperatures and rainfall provide conditions for continuous growth and development during most of the year.

A warm sheltered position on rich well-drained soil with abundant rain will produce high-yielding vigorous plants. Optimum conditions such as these are not encountered on the majority of Queensland's papaw plantations, as by far the greater number occur on the south-eastern coast, where winter temperatures during the four months from June to September, combined with cold winds and frequently occurring early summer droughts, are often sufficiently severe to affect adversely the development of the plant (Plate 65) or the maturation of the fruit. Occasional severe frosts, such as occurred in 1943, cause widespread damage among papaw plantations in low situations. By contrast, North Queensland plantations are not subject to the effects of frost or cold wind and the rainfall is much more favourable; however, cyclonic winds do occasionally take toll of plants in exposed positions on the tropical coast.

Although some hazards do exist, many excellent plantations are to be found in various select positions along almost the whole length of the Queensland coast. The following districts are the chief sources of papaws in this State:—

South Coast, from Coolangatta to Cleveland;

Brisbane district, including Sunnybank, Brookfield, and Aspley;

Near North Coast, in the vicinity of Nambour, Gympie, the Mary Valley and Gunalda;

Plate 65.
THE EFFECT OF WINTER CONDITION ON PAPAW PLANT DEVELOPMENT IS SHOWN BY THE CONSTRICTION OF THE STEM.

Central Coast district, principally the Yarwun area, Rockhampton, and Mackay;

Far North Coast areas of Ayr, Townsville, Cardwell, and Cairns.

Owing to the long distances from the larger southern markets and the attendant transport difficulties associated with such a perishable product, together with the absence of canning facilities in the north, the far north coast, though eminently suited to papaw growing, has been largely limited to supplying small local markets.

Plate 66.
A Papaw Tree Carrying a Crop of Good Quality Fruit.

Whilst the papaw is not a very difficult plant to grow, it will be found that attention to a number of details will materially enhance the prospects of establishing a commercial plantation and increasing the yield therefrom. The following sections deal with the important points to be observed.

PROPAGATION.

Seed Supply.

Until certified seed of proved varieties is available for general distribution, the papaw grower must rely for planting material on seed from fruit of recognized high-yielding trees, which produce good quality fruit (Plate 66).

Growers who wish to propagate from their own seed are referred to the Department of Agriculture and Stock Pamphlet No. 80, "Notes on the Papaw and its Improvement in Queensland," which deals in detail with the methods employed to secure pedigreed seed from chosen papaw trees of known performance.

Seed Treatment.

Seed freshly taken from the fruit should be cleared of the pulpy placental threads which generally adhere to them. The small membranous sacs of fluid surrounding the seeds may be broken by rubbing on a rough board and the seeds then freed of these by washing in water. They should then be placed in the shade, in shallow dishes, cardboard boxes or trays, to dry.

If it is intended to store the seed for a long period, it should be dusted with a fungicidal dust suitable for seed treatment and then stored away from the light in air-tight containers.

Time of Planting.

Successful germination may be obtained with papaw seeds at any time during the summer, from September to March.

Unless storm rains are experienced or irrigation is available, the early summer is a hazardous period in which to plant out young papaws, owing to hot drying winds and the danger from hail storms, which can seriously damage such young tender plants. If seeds are planted in early summer (October) they germinate in about ten days and the plants make rapid progress and commence flowering before winter retards further growth.

More commonly, however, seeds are planted during mid-summer (December) and young seedlings are then ready to transplant during late February or early March, when monsoonal rains usually provide wet and cloudy conditions suitable for the establishment of young trees in the field. These plants usually attain a height of about 2 feet before growth is virtually stopped by winter conditions, and flowering occurs about November. In this way March-planted trees generally bear their first crop closer to the ground than do trees planted early in the summer, which have a longer growing period during which the trunk may elongate appreciably.

Raising Seedlings.

There are a number of methods which may be used successfully in raising young papaw plants.

Seeds may be planted out directly in the field in their permanent positions. This method is generally adopted when plantings are made hurriedly, and also when planting in conjunction with crops such as pineapples, when the seeds are so placed that the leaves of the pineapples or other crop plant give protection and shade to the young seedlings. Planting out seed in an open field demands that constant care and attention be given, as otherwise many losses occur through the effects of insect enemies, disease and unsuitable weather. It is also necessary to have a fairly large supply of seed, as generally about a dozen seeds or more are planted to each tree position, and thinning operations carried out later if necessary. The advantages claimed for this method are that the procedure is simple; it eliminates losses due to transplanting; and deeper rooting is obtained.

Another method is to plant seed in prepared seed-beds and dig out seedlings for transplanting when they are about 6 inches high. A large seed-bed space is required for this practice, as plants cannot be spaced closer than about 4 inches apart without growing spindly. Roots are generally disturbed when transplanting is done and unless the lower leaves are pinched off the plants will probably wilt. A worthwhile practice, which reduces losses in transplanting from a seed-bed, is the wrapping of stems with a roll of firm paper from old books. This prevents scorching of the stems and keeps plants upright. It is always preferable to transplant on wet, cloudy days.

Plate 67.
Young Papaw Trees in Rocky Country.

A third, and probably the most certain, method of obtaining a good strike with young trees is that of planting in containers. Either the seed is planted directly in the containers, or seeds are first sown in shallow seed boxes holding 4 to 6 inches of soil, and when the plants are about 2 inches high they are transferred to containers such as fruit-preserving cans, sheet-metal tubes, or earthenware pots. Containers made from pineapple paper mulch have been used successfully for this purpose. When seedlings are from 6 to 8 inches high they are transplanted with the soil intact. Planting can be carried out successfully during dry weather provided plants are watered in, so that wilting does not occur. Two or three plants may be left in each container and later separated out at planting.

When transplanting, it is necessary to place plants at the same depth in the soil in their new positions as when they were in the seed-bed, otherwise the stems may become diseased. The importance of placing plants at the correct depth is often overlooked, with consequent failure.

PLANTING.

Tree Positions for Dioecious Papaws.

As there is no means of distinguishing "male" from "female" trees before flower buds appear, it is necessary to plant out at least three or four seedlings to each ultimate tree position (Plate 68). Normally, approximately 50 per cent. "males" and 50 per cent. "females" should result from a "male" and "female" cross, and the multiple planting allows for culling of any unwanted "male" trees. Thinning should be done so as to leave one "male" as a pollinator for every ten "females." In each tree position, only one "female" tree should be allowed to grow past the first flowering period, otherwise the plants become spindly.

If leaves are trimmed and roots carefully preserved, culled "female" trees can be dug out and replanted to other positions in wet summer weather. These trees will be set back somewhat, but if in healthy growing condition they soon recover.

Plate 68.
MULTIPLE PLANTING OF DIOECIOUS PAPAWS.

Tree Positions for Hermaphrodite Papaws.

It has been demonstrated, both in Queensland and overseas, that if hermaphrodite papaws are self-fertilized two-thirds of the progeny will be hermaphrodite and the remainder "females." If "females" are crossed with hermaphrodites, half the progeny will be hermaphrodites and the other half "females." In practice, this means the elimination of "male" trees in a planting where crosses of these types have been used, and all trees arising from the seed from these matings will be fruit-bearing; therefore, only one tree need be planted to each tree position. Good yields have been obtained in Queensland plantations of the hermaphrodite-female crosses.

If hermaphrodites only are required in the planting, then by planting three or four plants to each tree position the "females" can be culled out as in the case of superfluous "males."

Spacing.

Spacing distances for papaw plants in the field range from 6 feet by 6 feet to 12 feet by 12 feet according to the particular conditions. It has been observed that trees on virgin rain forest land grow very tall in the first year if planted too closely together, and thus often much of the first crop must be harvested by ladder. A spacing of 8 feet by 12 feet or 10 feet by 10 feet has been found suitable in these circumstances. Some growers plant 6 feet by 6 feet, but generally this is

Plate 69.
An Old Papaw Plantation, with Trees 30 feet High, making Harvesting Difficult.

considered to be too close, for though good crops have been produced with this spacing, the trees commonly become spindly. A close planting tends to give greater protection to fruits, greatly lessening the effect of adverse winds and sun scald. As the papaw is primarily a surface rooting plant, the soil surface should be kept shaded during the hot dry summer months, and close planting tends to achieve this end.

It was demonstrated in Florida that a 6 feet by 6 feet spacing actually increased the weight of fruit produced by 62 per cent. on the average over other plantings spaced 6 feet by 9 feet and 6 feet by 12 feet. This large increase in yield is explained by the extra number of trees planted per acre. Trees with the wider spacing of 6 feet by 12 feet actually produced more fruits per tree, the average being 23 as against 19.3.

An 8 feet by 8 feet spacing is considered to be generally satisfactory for average plantation conditions, except for the convenience of cultural operations or the peculiar requirements of certain varieties, and wider spacings such as 9 feet by 9 feet, 10 feet by 10 feet, or 8 feet by 12 feet may be found to give greatest efficiency in particular circumstances.

TABLE OF SPACING DISTANCES FOR SQUARE PLANTING.

Distance Apart.	Number of Trees per Acre.
6 ft. x 6 ft.	1,210
7 ft. x 7 ft.	889
8 ft. x 8 ft.	680
9 ft. x 9 ft.	537
10 ft. x 10 ft.	435
12 ft. x 12 ft.	302

PAPAW GROWTH AND DEVELOPMENT.

During 1940 and 1941 an experimental area of 500 trees of the Florida Betty variety was established at Nambour, on the lower north coast, on land which had previously grown pineapples. The following observations were made on 32 trees representative of the planting.

Flower Production and Fruit Set.

During the principal flowering period from November to late January the average number of flowers produced per tree was 46, or slightly more than an average of four flowers per week. The percentage fruit set varied from 47 per cent. to 73 per cent. for individual trees, with an average setting of 63 per cent. for all flowers produced. A much lower percentage fruit setting could be expected from the late summer flowering, as the protracted wet weather often experienced in February, March, or April prevents natural pollination. There were slightly more than 10 per cent. "male" trees in this plantation to act as pollinators.

Yields.

The following table gives the percentage of fruits in grades according to weight, the largest fruits being mainly produced by December flowers:—

Fruit Weight.	Percentage.
Less than 1 lb.	4·3
From 1 to 2 lb.	12·8
From 2 to 2½ lb.	30·8
From 3½ to 5 lb.	29·3
From 5 lb. and over	22·8

Average tree production for the first crop from the main flowering period (November to January) was 29 fruits per tree, with average weight of 2 lb. 14 oz. per fruit, which gives a crop yield of 83·4 lb. per tree. This is equivalent to slightly more than 3 bushels.

Fruit Development.

The time taken for complete fruit development from flowering to maturity of the fruit varied from 175 to 275 days. Fruit from early summer flowers reached maturity in much less time than did those from late summer flowers.

Month of Flowering.	Fruit Development in Days.
November	175 to 185
December	175 to 240
January	230 to 260
February	255 to 275
March	230 to 260

The foregoing indicates that an early winter crop maturing in May and June was produced by November and December flowers, whereas the spring crop in August and September was produced by late summer flowers. The effect of winter in retarding maturation is evident by the additional time taken to reach maturity—in this instance from 50 to 70 days.

Plate 70.
A Branched Papaw Tree.

BRANCHING.

Branching (Plate 70) commonly occurs in papaws as a result of injury to the growing tip. Some strains, however, have a tendency to branch more than others and will do so to a considerable extent, even in the absence of an injury.

Where optimum conditions for vigorous growth are experienced, allowing young trees to carry branches has been successful; but most branched trees produce smaller fruit than single stemmed trees and, except under the most favourable growing conditions, the practice is not recommended.

Highly placed branches are often broken off from the main stem by wind or by the weight of fruit they are carrying, and branches which project at an angle from the main stem require propping or tying back to avoid this trouble.

CUTTING BACK.

Aged trees which are in a healthy condition can be rejuvenated by cutting the stem down at a point about 2 feet above ground where the stem is not hollow. This can also be done with young trees that have grown too tall for convenience of harvesting. After being so cut, the tree will shoot from a number of places on the stump, and two or three of the most vigorous shoots are then allowed to grow. This cutting operation should be done during the early spring so as to allow a sufficiently long growing period for the plant to recover. It is a good practice to cover the cut surface of the stem with a tin to prevent cracking and subsequent decay.

HARVESTING.

In Southern Queensland, though small quantities of fruit may be ripening throughout the most of the year, there are two important harvest periods—one during April, May, and June, and the other, which is really the main one, during September, October, and November. In Northern Queensland harvesting is spread over a longer period.

For local markets fruit should be harvested in the firm-ripe stage when the first colour is showing, and should fully ripen in from four to five days. For export to Southern markets fruit should be picked at an earlier stage, allowing about eight days before fully ripening. The stage of maturity, as gauged by external colouring of the fruit, will vary according to seasonal conditions, the variety grown, and the requirements of the buyer, but generally the fruit should be harvested at an earlier stage in the summer than in the winter.

Great care must be exercised in harvesting papaws in the firm-ripe stage as they bruise easily. The fruit should be cut from the tree and not pulled, as pulling often results in damage to the basal end. Fruit stalks should be cut close to the tree stem, to prevent remaining fruits from rubbing on the stub. Finally, the stalk on the fruit should be trimmed before packing.

The milky latex which exudes from the broken rind of immature papaws causes considerable irritation to the skin of the operator handling them for any lengthy period and the wearing of rubber gloves and an apron is therefore recommended.

SOILS AND FERTILIZER REQUIREMENTS.

In Queensland, papaw plantations are placed either on virgin land recently cleared of rain forest or hardwood forest, or on "old land," which has been under cultivation to pineapples, bananas, or other crops for several years. These soils vary considerably in type and include brown sandy soil, alluvial clay loam and red volcanic loam.

Many plantations are necessarily placed high up on hillsides to avoid frost, and are thus frequently associated with rocky and gravelly soils. A free draining soil is essential to healthy growth; waterlogging will result in stunted growth which is generally accompanied by disease.

Where natural soil fertility is high, excellent yields of high-quality fruit have been obtained without the use of fertilizers. More typically, however, plantation sites occur on soils of low or medium fertility, in which plant nutrient materials have been depleted by continuous cropping over a long term and by losses due to erosion and leaching. The papaw tree draws heavily on the water and plant food supply of the

surrounding soil for at least eight months of the year during its active growing period, and to support and maintain this long period of activity liberal amounts of water and plant food must be available.

During 1940 and 1941 experiments were conducted at Nambour, on a brown sandy loam, typical of much of the soil on which this fruit is grown. All trees in the experiment received the same amount of nitrogen. There were no responses to phosphate or potash treatment, except in the case of phosphate after liming. Phosphates significantly increased the yield in the presence of lime and depressed the yield in the absence of lime. (Hydrated lime was applied at the rate of 4 tons per acre.) Soils under this test ranged in pH value from 4·5 to 5.

Experiments conducted at the Hawaiian Agricultural Experiment Station have shown that ample supplies of nitrogen and phosphate are necessary and that an increased quantity of potash is required after the flowering stage has been reached. The use of a 6-12-6 mixture, given at the rate of 2¼ lb. per tree per year, in four quarterly applications, has been found beneficial.

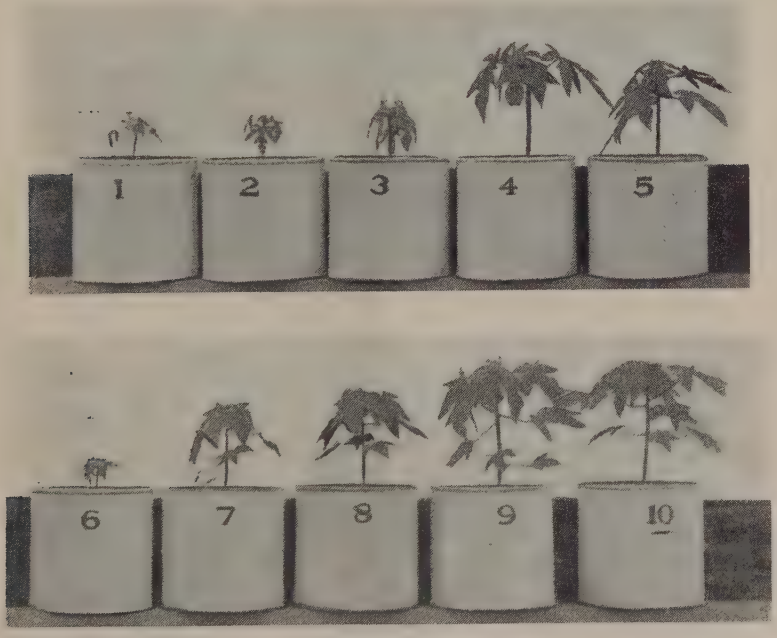

Plate 71.

Showing the Effect of Organic Manures (Pots 4, 5, 9, 10) Compared with Inorganic Fertilizers (Pots 2, 3, 7, 8) and no Fertilizer (Pots 1, 6). The Bottom Series was Limed.

Comprehensive experiments conducted in Florida demonstrated that greatly increased yields were obtained from comparatively large annual applications of fertilizer. The recommendations for that State include the use of a 5-6-5 mixture for young trees, given at the rate of 3 to 4 oz. per month, and for mature trees up to 1½ lb. of a 4-8-8 mixture per month during the growing season.

In North Queensland, results of trials with potted seedlings, which were conducted with young seedling papaw plants up to 15 weeks after germination, indicated that favourable growth response was obtained

from the use of organic fertilizers, particularly dried blood. The growth increase for plants receiving organic fertilizers, as determined by stem height, was measurably greater than was the case where an equivalent amount of nitrogen was supplied as sulphate of ammonia. This is shown in Plate 7, where pots 4 and 5, in an unlimed series, and pots 9 and 10 in a limed series, received organic manures.

VALUE OF LIME.

Plate 72 illustrates the effect of liming on the root development of young papaw seedlings grown in pots. A more vigorous fibrous root system was developed in all plants receiving lime. There was no general significant increase in stem height due to lime in this experiment. In

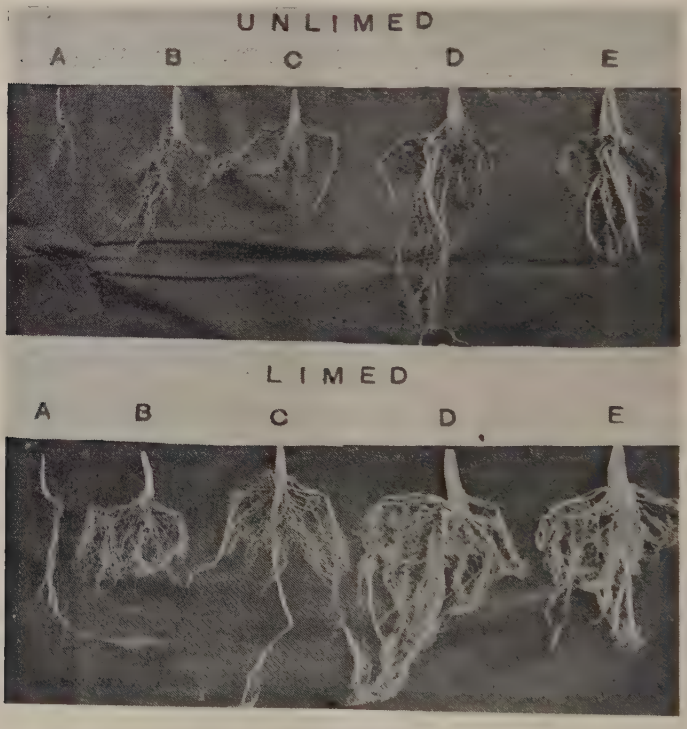

Plate 72.
SHOWING THE EFFECT OF LIMING ON ROOT DEVELOPMENT OF PAPAWS.

this pot trial plants receiving no lime showed chlorotic symptoms and dropped their lower leaves prematurely, leaving an "umbrella" top as seen in Plate 71 (Nos. 1 and 5 were unlimed and Nos. 6 and 10 were limed). This experiment was conducted at South Johnstone, North Queensland, on silty alluvial loam with pH of 4.7 to 5.7.

In a pot experiment with Nambour sandy loam more than 100 per cent. increase in height during the first 21 weeks was obtained by the application of hydrated lime at the rate of 4 tons per acre.

GENERAL FERTILIZER RECOMMENDATIONS FOR QUEENSLAND.

Although much information remains to be obtained by experiment under varied soil conditions in order to put forward recommendations which will suit each of the diverse soils on which papaws are grown, it is considered that the following measures will prove satisfactory in most instances.

An 8-12-6 mixture applied at the following rates per tree:—

(1) 4 oz. for trees up to 3 months old;

(2) 12 oz. for trees up to 6 months old;

(3) 2 to 3 lb. for trees 1 years old and upwards.

Fertilizer should be applied in three or four applications during the growing and blossoming period in September, November, and February, with a light application in April. On depleted soils a basal dressing at time of planting is to be recommended. Hydrated lime as an initial application, broadcast at the rate of 3 to 4 tons per acre, should be beneficial, particularly on soils registering below 5·5 on the pH scale.

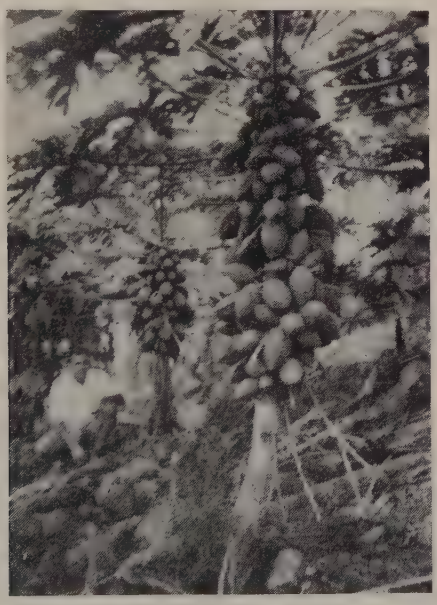

Plate 73.
A Young Papaw Tree in Crop, Gunalda District.

Lime, applied about three months in advance, combined with a legume cover crop before planting the trees, will assist in restoring fertility in many so-called "worn-out" coastal orchard lands, which it is intended to plant with papaws.

CULTIVATION.

The manner and method of cultivation of papaw plantations vary considerably with the type of plantation. Many of these are so steep and rocky that anything other than hand cultivation is precluded. The distance of plant spacing will also influence the method of cultivation

employed. Owing to the shallow-rooting habit, it is impossible to do more than stir the first 3 or 4 inches without doing considerable injury to the roots. It is imperative, however, that weeds be suppressed, particularly during the dry spring and early summer months. Papaws respond well to mulching with dry grass hay, cowpea hay or other litter. The mulch cover, besides retarding surface evaporation, also helps to suppress weed growth and is a constant supply of decomposing organic matter, slowly building up the humus content of the soil.

PAPAWS FOR CANNING.

Canned papaw, either as diced papaw or as an ingredient in canned fruit salad, has become a product for which there is an increasing demand. Plantations situated close to canneries, principally in the Brisbane district, have been the main sources of supply.

The best fruit type for canning is oval in shape with no corrugations, weighs from 3 to 4 lb., and has a firm orange coloured flesh, one inch to one and a-half inches thick.

Papaws for canning should be picked so as to arrive at the cannery in the firm-ripe stage, and they should not carry an excessive amount of blemish due to fruit rots.

As the canned product becomes more popular, and improved varieties are more commonly grown, there will be greater scope for development on this side of the papaw industry.

Plate 74.

A CLONCURRY RIVER CROSSING, NORTH-WESTERN QUEENSLAND.

Deficiency Disorders in Deciduous Fruits.

K. M. WARD, Horticulturist.

THE proper nutrition of fruit trees depends not only on the supply of major mineral elements, such as nitrogen, phosphorus and potassium, but also on the availability of what are known as trace elements, which function in regulating growth processes. Deficiencies in the supply of these trace elements rapidly produce serious effects in deciduous fruit trees, causing suppression of growth, dying back of shoots and branches, and pronounced abnormalities in the fruit. Though certain symptoms of such deficiency disorders may resemble those of diseases caused by fungi, bacteria or viruses, treatment lies not in the application of fungicides but in supplying the required element.

In the Stanthorpe district, where most of Queensland's deciduous fruits are produced, nearly all species of these fruits are affected by deficiency disorders, but it is in apple trees that the troubles are most prevalent. These trees suffer from deficiencies of zinc, copper and boron, and any combination of these disorders may occur in an individual orchard. Pears are affected by zinc and copper deficiencies, whilst stone fruits mainly show a lack of zinc, and a number of varieties of grapes are benefited by applications of boron.

These troubles are known by names which partly describe their symptoms. Thus, zinc deficiency is known as little-leaf, copper deficiency as wither-tip or summer dieback, and boron deficiency in apples as internal cork and measles. These various disorders have been the subject of investigation at Stanthorpe during a period of five years, and it is now possible to present the findings in summarised form and give practical control recommendations. Because of the fact that the troubles can be controlled effectively and cheaply none of them need cause very serious losses in any commercial orchard.

LITTLE-LEAF.

Little-leaf has become increasingly prevalent in Stanthorpe orchards during the last ten years, appearing each year in previously healthy orchards irrespective of their age. The disorder has occurred on all the main local granitic soil types, and though predominantly affecting apple trees it also occurs in pears and stone fruits and is suspected of being present in grape vines. The control of the disorder is therefore of considerable importance to the fruit-growing industry.

Little-leaf is most readily recognised during the months of October and November, when the typical "little-leaf" stage of the disorder (Plate 75) is most plainly shown. This stage is preceded by a delay of as long as two weeks in the leafing-out of the terminal shoots on one or more branches of the tree. When the leaves do appear they usually remain greatly reduced in size, are rigid and narrow, and they develop very slowly, if at all, and thus form a rosette at each bud on the parent wood. This dwarfed condition of the foliage is usually confined to the younger wood on leader and sub-leader branches. Chlorosis or mottling of the small leaves, and also of other nearby foliage, is a common symptom during late spring and summer; such leaves are

Plate 75.

LITTLE LEAF OF APPLE.—Left, normal spring growth. Right, shoot showing "little-leaf" stage.

yellowish in the areas between the veins, but tissues near the veins remain green. Terminal shoot growth on affected branches is either greatly suppressed or completely lacking (Plate 76).

In the growing season following the appearance of this little-leaf growth the buds on affected shoots may fail altogether to break and thus neither foliation nor shoot elongation takes place. Later these shoots commence to die from the tip and this dieback proceeds downwards into older wood, a characteristic feature of this stage being the clearly defined line of demarcation between dead and living tissues. In the early stages only a few branches of a tree may show symptoms of the disorder, but the whole tree is liable to become affected within a few seasons. Sometimes the trouble is confined to one side of a tree for some years and this results in lopsided development.

Fruit produced on seriously affected trees is dwarfed but otherwise its general appearance is not affected. The cropping capacity of such trees is decreased, owing to the reduction in the amount of fruit-bearing wood.

Treatment.

Experiments have shown that zinc sulphate sprays applied in winter give responses that are more extensive, more rapidly shown and more enduring than foliage sprays or any other treatment. Foliage sprays act more slowly and the effect disappears quickly and treatment

Plate 76.

LITTLE-LEAF OF APPLE.—Tree showing suppression of terminal growth on affected branches.

Plate 77.

LITTLE-LEAF OF APPLE.—The tree shown in Plate 76 photographed after restoration to full vigour by winter spray treatment.

by this method would therefore involve an application of spray every year. Initial measures with winter sprays to remedy the little-leaf condition and restore health to zinc deficient trees require the application of zinc sprays in July or early August for two successive years. Each spray should consist of 20 lb. of zinc sulphate in 80 gallons of water, but if the trees are severely affected the strength of the first application should be increased to 40 lb. per 80 gallons. After the initial applications in two consecutive years the weaker spray should be applied in alternate years to maintain a supply of zinc to the trees (Plate 77).

It is preferable to apply the winter spray before pruning, but if this is impracticable the application should be delayed for at least two weeks after pruning in order to avoid any injury that may result from the entry of the spray solution through the newly-cut wood (Plate 78).

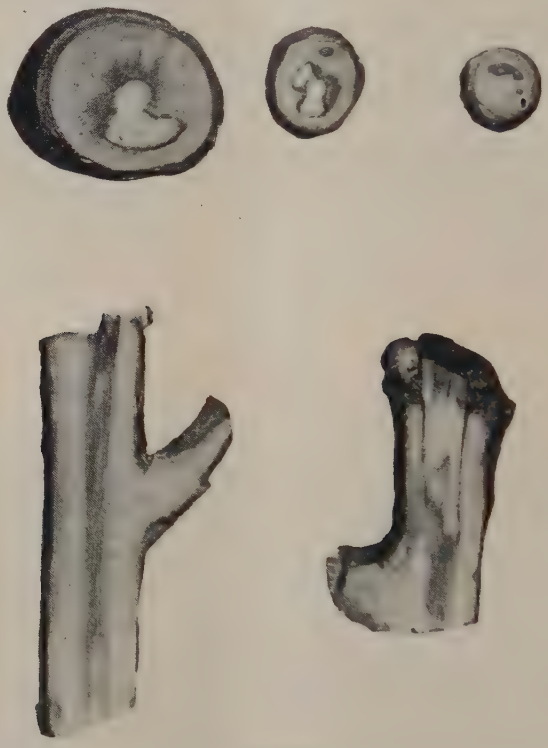

Plate 78.

LITTLE LEAF OF APPLE.—Sections through branches in which wood tissue was killed by spraying immediately after pruning.

WITHER-TIP OR SUMMER DIEBACK.

For a number of years the cause of the dying back and withering of the tips of the current season's shoots, mainly on apple trees, was unknown; but it was eventually observed that affected trees sprayed with Bordeaux mixture in late spring recovered from the trouble in the following year. Subsequent investigation has proved that the condition can be controlled by supplying the trees with copper and it has been concluded that the disorder is due to the unavailability of this element.

Wither-tip is rather widespread in the Stanthorpe district, where it affects all varieties of apples whether they are young trees just established on newly-prepared land or old trees past their prime. Occasionally the disorder occurs on pear trees, but it has not, as yet, been observed to affect stone fruit trees. In South Africa, however, plums, peaches, and apricots growing on certain sandy soils have

Plate 79.

Wither-tip of Apple.—Second stage of the disorder, showing dead leaves and defoliation.

exhibited the yellowing of the leaves and serious rosetting, the formation of multiple buds, the dying back of branches and a sharp decline in yield, and this condition, known as exanthema, has been attributed to copper deficiency. Furthermore, treatment of exanthema in plums and other fruits with copper sulphate has been described from Western Australia and elsewhere, so that it is possible that similar trouble may be found on stone fruits in this State at some future date. The first outward symptoms of wither-tip are to be seen towards the end of

spring when the apical growth on the current season's shoots stops and takes on an unhealthy appearance. Young, partly grown leaves and the older leaves near each tip next begin to show brown areas in which the tissues soon die (Plate 79). These dead and dying areas usually take the form of large, irregularly-shaped, brown blotches, but in the Delicious variety they begin as numerous small reddish patches which soon die, leaving many small blotches about $\frac{1}{8}$ inch in diameter, somewhat like a

Plate 80.

WITHER-TIP OF APPLE.—Final stage of the disorder, showing the tips withered, curved, and completely defoliated.

stage of shothole disease in stone fruit leaves. The occurrence of these dead patches is soon followed by the death of the leaves, which then fall, and thus the shoot becomes defoliated for upwards of 9 inches from its tip. This portion of the shoot wilts, dies, and withers, and becomes characteristically curved to one side (Plate 80). If this stage is reached early in the season, new twig growth arises from live buds lower down the shoot (Plate 81), and these in turn become affected before the end of the season.

This disorder, unlike little-leaf, is not confined to the terminal shoots of leader branches, for although it is conspicuous in top growth it also develops on young shoots in any other part of the tree. The total effect is to cause a marked suppression of growth and a general loss of vigour (Plate 82).

Plate 81.

WITHER-TIP OF APPLE.—Showing secondary twig growth which has in turn become affected.

Associated invariably with this wither-tip condition is a typical roughening or scurfiness of the bark on wood that is one or more years old. This scurfiness, which is due to the presence of numerous fine cracks in the bark, does not extend to the underlying wood, but it may cover the greater part of a young tree down to ground level (Plate 83). In the absence of treatment the cracks deepen and the roughness becomes more coarse and flaky. Fruit characters do not appear to be affected by this disorder. Pears exhibit symptoms similar to those of apples.

Plate 82.
WITHER-TIP OF APPLE.—Young affected tree in which top growth has been severely suppressed.

Plate 83.
WITHER-TIP OF APPLE.—Showing scurfiness of bark on young tree.

Treatment.

It has been found in local experiments that wither-tip can be quite satisfactorily controlled by supplying copper to affected trees. The method of treatment may be varied according to the age of the trees. Young non-bearing trees respond very well to a 4:4:40 Bordeaux spray applied in late spring, and the benefits from a single application may last several years. This method of application is not advisable for bearing trees because the spray is likely to cause russetting of the fruit.

A preferable treatment for both bearing and non-bearing trees is a soil application of $\frac{1}{4}$ to $\frac{1}{2}$ lb. per tree of fine copper sulphate crystals, i.e., "bluestone". This material should be broadcast evenly over a large area around each tree and ploughed in late in winter. The copper thus applied usually becomes available to the trees in time to cure wither-tip in the following spring and summer; trees receiving this treatment in experimental work have so far remained free from the trouble for five years. It is advisable to avoid using the large bluestone crystals employed in the preparation of spray mixtures, for such material when applied to the soil may give rise to such localised concentrations of copper sulphate within the root zone as to cause root injury; the fine crystals are available and inexpensive.

Among other methods of treatment tested is the spraying of the trees in winter with Bordeaux at a strength of 6:4:40. The evidence obtained in experimental work clearly indicated that such winter spraying was not effective for the control of wither-tip.

BORON DEFICIENCY DISORDERS.

From time to time apple fruits become affected by several related disorders which are due to boron deficiency. Of these, internal cork is the most common, but corky-core and superficial cork, or drought spot, also occur. These troubles produce serious defects in the fruit, but fortunately they are not very prevalent in Stanthorpe orchards and occur rather spasmodically, though orchards in which they appear are widely scattered in the district. Internal cork, for example, may develop one year, and without treatment may make no further appearance for several ensuing years. However, it is all too evident that boron deficiency arises in Stanthorpe soils, and fruit trees, therefore, require treatment from time to time.

INTERNAL CORK.

Boron deficiency symptoms in apple fruits vary in different varieties, the most striking effects being shown by the Granny Smith. At the earliest stage in the development of symptoms, greenish-coloured areas appear in the flesh of the fruit; when near the surface, such areas may be visible through the skin. Later these patches become brown and spongy or corky, thus giving the typical appearance of internal cork; they usually lie scattered throughout the flesh. The Granny Smith is also very subject to malformation, notably to surface dimpling or knobbiness which is associated with the internal corky lesions. If the apples become malformed when still quite small they do not grow much more, but remain seriously mis-shapen and stunted. Many of them fall from the tree before ripening.

CORKY CORE.

The corky core form of boron deficiency occurs notably in Jonathan and McIntosh and is evident as corky brown lesions in the core region only. Dimpling of the surface and other malformations have not been observed in these varieties, affected fruits retaining their normal appearance externally. Fruits of the Delicious variety have not exhibited any form of internal cork though they sometimes show dimpling in a mild form.

SUPERFICIAL CORK OR DROUGHT SPOT.

Superficial cork or drought spot, which often appears early in the life of the fruit, at first occurs as a russetting or brownish wrinkling accompanied by slight cracking in patches on the skin. As the condition develops these patches become roughened, the cracks deepen, and areas of skin become dark-brown. In the final stage, very deep and wide cracks appear extending perhaps up to one-third or more of the distance around the fruit, resulting in severe malformation. Fruit affected early in its life remains dwarfed. No internal browning appears to be associated with this form of boron deficiency. This type of cork has been observed on Jonathan and Delicious, and its occurrence on Dunn and other varieties is suspected.

In New Zealand a brown spotting in the flesh of apricots, particularly in the region near the stone and, in mild cases, largely confined to the stem end, has been found to be due to boron deficiency. Dropping of fruit is also associated with the condition. This trouble has not been observed in the Stanthorpe district, but if symptoms similar to those described should appear in apricots here a form of internal cork might well be suspected.

Plate 84.
MEASLES OF APPLE.—Showing pimple stage of disorder.

MEASLES.

In recent years, a disorder which is attributed to boron deficiency and which affects particularly the bark of Delicious and Jonathan trees has been observed in a number of orchards. This condition, which is known as measles, is characterised by the development of innumerable pimples or blisters on the bark of the tree (Plate 84). These first appear on the youngest wood during autumn and winter each year. In the following year the pimples enlarge and the bark cracks and becomes very coarse (Plate 85); the affected areas may merge into each other. The bark near such areas is usually reddish in colour and red streaks may occur in the wood. This condition may affect one or more branches on a tree and invariably it causes stunting

of growth, usually to a serious extent. Foliage on affected branches does not appear to develop any characteristic symptoms of distress. The fruit, however, on some affected trees has produced well-marked symptoms of superficial cork, whilst on others the only symptom that might be associated with the condition is an abnormal amount of dimpling in Delicious.

Plate 85.

Measles of Apple.—Showing coarse cracked bark and stunting of growth.

"HEN AND CHICKENS" IN GRAPES.

Some varieties of grapes in the Stanthorpe district are rather seriously affected by a condition commonly known as "hen and chickens," in which part or the whole of a bunch may consist of seedless berries too small for use as table grapes (Plate 86). Among the varieties chiefly affected by this trouble are Waltham Cross (Rosaki), Muscat and Henab Turki, which too often produce non-commercial crops because of it. Experiments have demonstrated that, under Stanthorpe conditions, treatment with borax usually reduces the incidence of "hen and chickens" to negligible proportions.

Plate 86.

"HEN AND CHICKENS" OF GRAPES.—Two bunches of Henab Turki on right affected by "hen and chickens." Bunch on left from vine treated with borax.

TREATMENT OF BORON DEFICIENCY DISORDERS.

The cork diseases described herein respond satisfactorily to treatment with borax applied either through the soil or as a foliage spray. Soil applications at the rate of ½ lb. of borax per large sized tree, or half this amount for a small or immature tree, should be ploughed in during late winter or early spring; such treatment is usually effective in the ensuing growing season. Care must be taken, however, to broadcast the material widely and evenly around each tree, and in order to achieve this it is advisable to mix the borax thoroughly with several times its own volume of dry sand or fine soil. Concentrations of borax in the root zone caused either by careless application or by placing it in a trench or furrow near the tree must be avoided, for it has been found that, under local soil conditions, borax rapidly becomes available to plants, and slightly excess quantities produce serious toxic effects. A large tree, for instance, can be injured by 1 lb. of borax, and it is therefore important that stipulated amounts should not be exceeded in any soil dressings. A soil application will remain effective for several years, and for this reason the treatment is preferable to any other.

If it is necessary to use foliage sprays they should consist of ½ per cent. borax solution, or 4 lb. borax in 80 gallons of water; a single application made during November will prevent the development of cork during that season, and possibly a little longer. Boric acid can be substituted for borax at the rate of 3 lb. per 80 gallons. Both soil and spraying treatments are applicable also to trees affected with measles.

Summary of Recommendations for the Control of Deficiency Disorders in Deciduous Fruits.

Name of Disorder.	Deficient Element.	Method of Control and Material Used.	Time of Application.
Little-Leaf	Zinc	Zinc sulphate spray, 20 lb. per 80 gall. Applied two years in succession, thereafter in alternate years. Double strength in first year in severe cases	July—early August
Wither-Tip or Summer Dieback	Copper	Copper sulphate in soil ½ lb. per tree .. or On non-bearing trees 4 : 4 : 40 Bordeaux	Late winter—early spring November
Internal Cork .. Corky Core .. Superficial Cork or Drought Spot	Boron	Borax soil application ¼ to ½ lb. per tree	Late winter—early spring
Measles..	Probably Boron	Borax spray, 4 lb. per 80 gall. ..	November
"Hen and Chickens" in Grapes	Probably Boron	Borax soil application 2 ounces per vine or Borax spray, 4 lb. per 80 gall. ..	Late winter—early spring 2 to 3 weeks before blossoming

Grape vines subject to the "hen and chicken" condition also respond equally well to a soil application of borax or a foliage spray applied at the correct time. In the case of the soil treatment each vine should receive two ounces of borax widely broadcast and cultivated in during late winter or early spring. Here again it is important that the dressing be evenly distributed around each vine and for this purpose borax should be mixed with dry sand. A soil application has been known to remain effective for three years on Waltham Cross grapes, and after that period reversion to "hen and chickens" has taken place. Spraying with ½ per cent. borax solution is effective if applied three weeks before flowering. However, the full effects of this treatment are felt only in the following growing season and reversion to "hen and chickens" may occur in the next year unless the application is repeated.

SPRAY COMBINATIONS.

The fact that it is necessary to use various trace elements in sprays in order to control deficiency disorders in deciduous fruits has given rise to many enquiries concerning the possibility of combining these materials with insecticides and fungicides applied as sprays. Generally speaking, the number of such combinations which function efficiently is rather limited, for it is not often that such a mixture, applied for a dual or triple purpose, will exert its full effect on each of the troubles with which it is desired to deal. This is largely because the correct timing of spray applications usually plays such an important part in pest and disease control. Then again, the safety or otherwise of some combinations under different seasonal conditions, and prepared with water obtained from different sources, is not always predictable. In the light of the recommendations given in this article for the control of deficiency disorders it will be seen that there are not many opportunities to use such combined sprays; for little-leaf is best controlled by a winter spray applied somewhat earlier than the winter pest-control sprays whilst wither-tip and boron troubles are most suitably dealt with by soil treatment.

Considerations of cost or availability of materials may sometimes make the use of alternative methods of treatment necessary or desirable, and information on potential spray combinations is then useful. The effectiveness of zinc sulphate in controlling little-leaf is not impaired when it is combined with winter strength lime sulphur, and the mixture of these substances is not injurious to the trees. The mixing of these two, however, results in the formation of a heavy precipitate in the spray vat and therefore the combination may be inconvenient to use. When oil emulsions and zinc sulphate are mixed, a reaction occurs which results in the probable destruction of some of the insecticidal properties of the oil. If it is desired to use a winter oil spray it is sound practice to avoid spraying the trees just prior to the application of zinc sulphate as the oil then tends to prevent the zinc spray from adhering to the bark, and also from penetrating the plant tissues. It is preferable therefore to apply the zinc sulphate in, say, early July and the winter oil a month later. Zinc foliage sprays are not recommended for little-leaf control and therefore their combination with summer spray materials need not become a problem.

Bordeaux mixture for application in November to control withertip can safely be combined with arsenate of lead, white oil or nicotine sulphate, but not with lime sulphur. On apple and pear trees ½ per cent. borax solution has been combined with standard arsenate of lead sprays without causing injury to the trees.

QUEENSLAND SHOW DATES.

Queensland Agricultural Show Societies are quickly moving again into active organization, and appended is a list of show dates, registered up to 10th January by the Queensland Chamber of Agricultural Societies, for 1946:—

APRIL.

Mount Perry	27th
Nanango	26th and 27th
Roma	30th, and 1st and 2nd May

MAY.

Monto	1st and 2nd
Kingaroy	1st, 2nd, and 3rd
Eidsvold	6th and 7th
Murgon	9th, 10th, and 11th
Beaudesert	8th and 9th
(Camp Draft 10th and 11th)	
Kilkivan	17th and 18th
Esk	17th and 18th
Gympie	22nd and 23rd
Biloela	23rd and 24th
Laidley	24th and 25th
Blackbutt	24th and 25th

JUNE.

Kalbar	1st
Boonah	7th and 8th
Childers	10th and 11th
Lowood	14th, 15th, and 17th
Gin Gin	17th and 18th
Rockhampton	19th to 22nd
Mackay	24th to 27th
Toogoolawah	28th and 29th

JULY.

Proserpine	5th and 6th
Rosewood	12th and 13th
Gatton	19th and 20th
Cairns	23rd, 24th, and 25th
Yarraman	26th and 27th
Ipswich	30th and 31st, and 1st and 2nd August

AUGUST.

Lawnton	2nd and 3rd
R.N.A.	12th to 17th

SEPTEMBER.

Canungra	7th
Beenleigh	20th and 21st

OCTOBER.

Nerang	4th and 5th

PLANT PROTECTION

The Fruit Spotting Bug.

W. J. S. SLOAN, Agronomist.*

THOUGH the fruit spotting bug† feeds on many plants, it is best known as a pest of the papaw in coastal districts of central and north Queensland. The insect has also been recorded further south though seldom in sufficient numbers to injure the plants on which it feeds. Papaw plantations located near standing scrub are particularly susceptible to attacks, as are also trees in home gardens of coastal towns. In addition to the papaw, host plants of the bug include passion fruit, granadilla, banana, custard apple, mango, pineapple, cassava, beans of various types, frangipanni, Peltophorum and some native trees such as white cedar and the rough leaved fig.

Injury.

Papaw trees of all ages are attacked by both immature and adult bugs, but injury is most severe on those that are less than nine months old. The damage to the growing tip is particularly serious, but green and ripe fruits may also be injured. Sap exudes from the feeding punctures and small lumps of congealed latex on the growing tip are usually an early symptom of infestation. The plant tissue at each puncture becomes depressed and cracks later appear on the injured stem or leaf stalk. Cracks in the leaf stalk may develop into splits up to 4 inches in length; cracks in the main stem may be $\frac{1}{4}$ inch deep.

Injury in seedling papaws is sometimes fatal if the plants are neglected, but older trees survive even heavy and prolonged attacks. Where the terminal is killed, side shoots are usually formed and these may develop normally if they are not infested (Plate 87). Moderately injured terminals will recover if growing conditions are good and the bug population declines. When trees are shaded and bug populations are high, the growth of sooty mould fungi on the congealed latex at or near the bug punctures makes the stem and leaf stalks seem dirty and unthrifty. The appearance of papaw trees in which the growing tips have been injured is very characteristic for the terminal growth consists of a dense bunch of leaves with short, distorted stalks (Plate 88). The bunching effect is due to the suppression of normal growth and the internodes are consequently very short. The bug does not appear to seriously affect trees once flowering has begun, but attacks on the young papaws may delay the commencement of flowering. Some shedding of fruit occurs on weak trees, but, in general, setting is not affected. In this respect,

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* Formerly an officer of the Science Branch.

† *Amblypelta lutescens* Dist.

Plate 87.

YOUNG PAPAW TREE WITH TWO HEALTHY SIDE SHOOTS FORMED AFTER THE ORIGINAL TERMINAL HAD BEEN DESTROYED.

Plate 88.

YOUNG PAPAW TREE SHOWING BUNCHED TERMINAL GROWTH WITH STUNTED LEAVES AND LEAF STALKS.—Normal stem and leaf growth has been resumed following removal of fruit spotting bugs by handpicking.

the fruit spotting bug on papaws differs markedly from a related species* attacking coconuts in the Solomon Islands. Vigorous, bearing trees apparently tolerate comparatively high bug populations without displaying marked abnormalities in growth. When papaw fruit are attacked by the fruit spotting bug, each feeding puncture is marked by a depressed lesion $\frac{1}{8}$ inch or more in diameter and dark-brown in colour.

On cassava and frangipanni, injury to the vegetative growth is similar to that already described on the papaw. On custard apple, granadilla, banana, passion fruit, pineapple, beans and mango, abnormalities in growth are less common and spotting of the fruit is more characteristic of the damage.

A small population of adult and immature bugs can cause injury to the host plant; one or two bugs on each papaw tree are often sufficient to stunt and distort the growing points within a month after the commencement of an attack. The severe reaction of the trees to such bug populations cannot very well be explained by the mechanical destruction of plant tissue during feeding. It seems probable, therefore, that plant toxins are introduced into the trees as the insects feed and that these produce the gross symptoms of injury recorded in the plantation. Immature bugs appear to be more injurious than adults, probably because the former are confined to one tree until they mature whereas adults may fly from tree to tree and feed on each for a short time only.

* *Amblypelta cocophaga* China.

Life History and Habits.

The eggs of the fruit spotting bug are pale-green in colour, oblong shaped with rounded ends, roughly triangular in cross section and approximately one-sixteenth of an inch in length. They are normally laid singly on papaw leaves, more particularly the older leaves, but occasionally they may be laid elsewhere, as, for example, on the trellis posts of passion fruit vines. The eggs hatch after an incubation period of four to six days during warm weather. The immature bugs emerging from the eggs are very similar to the adults in shape, though they are much smaller and lack wings. They are invariably red to reddish-brown in colour in the later stages of development, with two prominent dark-red spots on the back of the abdomen. The four-segmented antennae are long with the third segment somewhat flattened and dark-brown in colour. During summer, a period of from four to six weeks elapses after the hatching of the eggs before the bugs reach the adult stage. The immature bugs move slowly, and are conspicuous on the papaws because of their bright colour. They feed principally on the young leaves in the tender growing point of the tree, where they remain until the adult stage is reached. The adults (Plate 89) are slender winged insects about $\frac{1}{2}$ inch in length and approximately $\frac{1}{8}$ inch across the body. They are pale, yellowish-green in colour, sometimes with a brownish tinge, and they are consequently difficult to detect in the green foliage of papaws. Like the immature stages, they are generally found in the young growth among which they move freely on sunny days and readily take to flight when disturbed. Under cool conditions, they are rather sluggish and can be caught fairly easily in the early morning. The adult bugs may live for at least four weeks during the summer months.

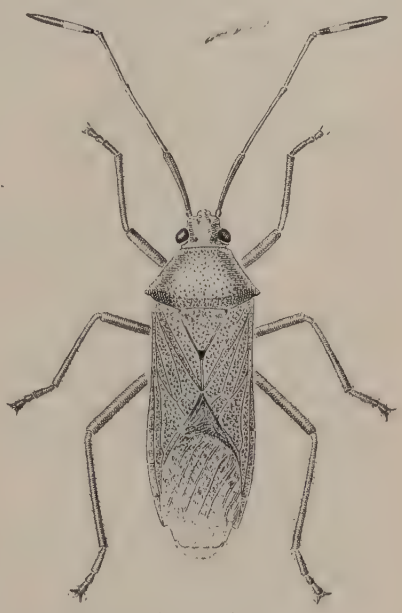


Plate 89.

Fruit Spotting Bug.—Adult x 4.

[*Drawing by William Manley.*

Fruit spotting bugs have been found on papaw trees growing in coastal areas of central Queensland throughout the year, but populations vary a great deal from month to month. They are usually most numerous in the autumn, but severe outbreaks may be encountered at any time, other than the cool winter months when activity is normally slight. Bug populations in papaw plantations temporarily fall to very low levels after cyclonic rains during the summer. On established

papaws, which have experienced bug attacks, the seasonal activity of the pest is clearly indicated by the occurrence of feeding scars and the presence of swollen areas with short internodes on the stem (Plate 90).

Control.

Papaw plantations are never uniformly infested by the fruit spotting bug and some trees appear to remain free from the pest throughout the year. A number may also react less severely to infestation than others in the same plantation; most papaws, however, are tolerant to the pest if they have been planted nine months or more, provided they have made good growth and are well cultivated. On the other hand, in gardens where only a few trees are growing, severe injury may occur on older papaws, particularly if they are close to other host plants of the fruit spotting bug.

Since the age and vigour of the papaw seem to determine its susceptibility to injury, good growing conditions should be maintained in the seed-bed and for at least nine months after the seedlings have been set out. It is advisable also to select seed from trees which, in addition to other desirable characteristics, show little or no bug injury. Where possible, papaw plantations should be located at least one-half mile away from areas of standing scrub which may act as sources of infestation.

Plate 90.

TRUNK OF PAPAW TREE, THE TERMINAL OF WHICH HAD BEEN INJURED, BUT NOT KILLED, BY THE FRUIT SPOTTING BUG.—The swollen portion of the stem with short internodes and scars indicates the height of the plant when attacked.

Hand-picking the bugs is a moderately effective and reliable method of protecting trees until they are old enough to tolerate injury under good growing conditions. Once the grower becomes familiar with the habits and appearance of the pest, the trees can be hand-picked rapidly, for the small lumps of latex at new feeding punctures and the distortion of young leaves in the terminal are easily distinguishable signs of injury. When moving along the rows, a glance at the terminal is sufficient to indicate whether the pest is active or not. Where bunches of distorted leaves have appeared on infested trees, sufficient of these leaves should be stripped away from the terminal to facilitate examination. Weekly inspections of the plantation should be made throughout the year, except during late summer and autumn when the trees may require examination twice each week, at least in those areas where previous experience has shown the pest to be active. These inspections are most efficiently carried out in the early morning when the insects are comparatively sluggish and can be easily collected. Seed-beds may also be protected by regular handpicking.

During routine inspections of the plantation, the tops of any seriously injured trees should be removed with a slanting cut made by a sharp knife. Strong shoots will then grow from the stem and one of these may be retained and, in common with the rest of the plantation, regularly examined and kept free from the pest. Such drastic treatment is not required in trees with lightly injured terminals for they normally recover when control measures are applied.

Should the grower prefer to use insecticides for the control of the fruit spotting bug, he may apply dusts containing nicotine or pyrethrum. Fortnightly applications of a 5 per cent. nicotine dust or a dust containing equal parts of ground pyrethrum flowers and kaolin have shown considerable promise in preliminary field trials. Both can be applied fairly easily with a knapsack plunge duster during the warmer part of the day. It is probable that sprays and dusts containing D.D.T. will also be useful for controlling the pest.

ANSWERS.

(Selected from the outgoing mail of the Government Botanist.)

Hibiscus. Ragweed.

C.J.C. (Acland)—

1. The plant with the poppy-like flower is the annual hibiscus or bladder ketmia (*Hibiscus trionum*). This plant is a very common weed particularly on black soil country on the Darling Downs and in Central Queensland. It is not a particularly aggressive weed and is not known to possess any poisonous or harmful properties at any stage of its growth.
2. It is difficult to be certain of weeds in the absence of seed heads but there is no doubt this is the Perennial ragweed (*Ambrosia psilostachya*). This plant is very difficult to eradicate because any of the underground portions when cut with a spade or plough is capable of forming a fresh plant. In small areas, constantly cutting and keeping down the green shoots so that they cannot nourish the underground parts is the most satisfactory method of dealing with it. In large areas, the plant can be treated with arsenical sprays, but several sprayings may be necessary before satisfactory results are achieved. The plant is a bad pest in some parts of New South Wales and South Australia, where sodium chlorate applied in a 10 per cent. solution—*i.e.*, about 1 lb. to a gallon of water—has been found more satisfactory than arsenical sprays, particularly if applied about September.

Gambia Pea.

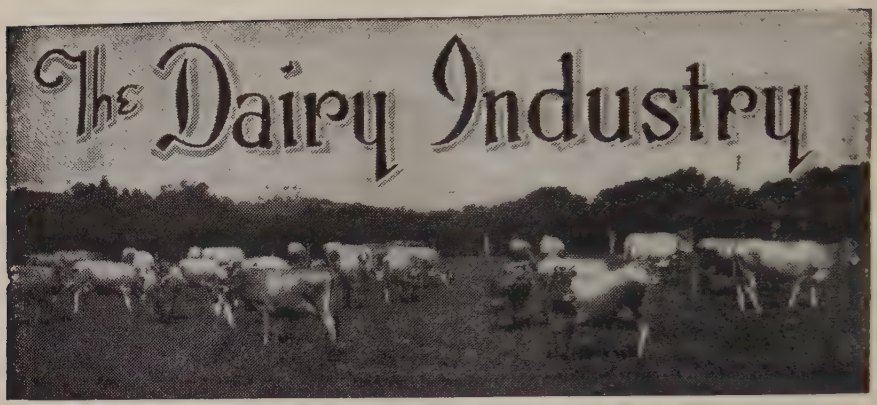
J.A.B. (North Arm)—

The specimen is the Gambia Pea (*Crotalaria goreensis*). This pea has been grown to some extent in Queensland as a green manure and is one of the best for the purpose. It has been planted fairly extensively on some of the sugar lands. The genus *Crotalaria* is a large one and some of the species both here and abroad have been proved poisonous to stock. So far as tests go, however, this one seems to be quite harmless though there is just a shade of suspicion about any of the group.

Cape Cotton.

F.A. (Clifton)—

The specimen is the white cotton or Cape cotton (*Asclepias fruticosa*). This plant is widely spread in the coastal areas of the State and though ornamental becomes rather a pest on coastal farms. It is particularly abundant in cleared scrub country. Feeding tests have proved it to be poisonous to stock, but is rarely eaten by them to any great extent. The bark produces rather a strong fibre, but the silky cotton surrounding the seeds has no textile value. It may, however, be used as a substitute for kapok. In the United States these various silky cottons are collected as substitutes for kapok.



Milk Spoilage by the Can.

V. R. SMYTHE, Dairy Research Branch, Division of Dairying.

IT is surprising how many dairymen are prepared to accept cans, in the condition in which they are returned from the depot, as being clean enough to contain milk. Often the only treatment they receive, before being filled with milk, is a perfunctory rinse. It is this lack of understanding which leads to one of the main causes of milk deterioration. Experience has shown that cans returned to the farmer vary widely in their cleanliness. Those which have had water residues left in them are by far the worst, but even a dry can may be stale smelling.

Recently, some tests were carried out on the deterioration which fresh milk suffers as a result of being transported in cans to the depots. The results of these tests are set out as a summary in the following table:—

Percentage of all Samples Tested.	Amount of Spoilage (Fall in Methylene Blue Test in Hours).
4·6	0
11·0	¼
12·9	½
17·4	¾
12·8	1
14·7	1¼
11·0	1½
3·7	1¾
4·6	2
2·8	2¼
1·8	2½
·9	3
·9	3½
·9	3¾
100·0	

These tests were conducted in such a way that the amount of spoilage which each milk suffered resulted from the milk can. It will be seen that only 4·6 per cent. of the milks showed no spoilage. The other 95·4 per

cent. showed spoilage equivalent to a shortening in the methylene blue test ranging from ¼ hour to 3¾ hours. The fact that over 50 per cent. of samples showed a shortening of more than 1 hour in the test demonstrates clearly that contamination from the can is too serious a factor to be ignored.

It was also found that the amount of milk spoilage is increased when the temperature of the milk is raised, and also when the period of transport is increased.

It is easy to see how a badly cleansed and sterilised can may contaminate and spoil milk when it is considered that the milk is in contact with the can surface for the whole of the period from farm to depot. During this time the can is lidded down and agitated by the jolting of the truck. Old cans which are pitted, cracked, or rusted present an additional menace in that the broken and uneven surfaces form a harbour in which milk-spoiling bacteria may lurk.

It is recommended that cans and lids be treated in the following way immediately on return from the depot:—

(1) Rinse out with cold or luke warm water.

(2) Scrub with hot water containing 1 cup of washing soda or 1 tablespoon of caustic soda to 4 gallons.

(3) Rinse with clean boiling water.

(4) Scald with boiling water.

(5) Up-end to drain and dry.

Immediately before the cans and lids are used they should be examined, and if they are not clean smelling the procedure outlined above should be repeated. Finally, cans and lids should be rinsed with a chlorine solution. This solution can afterwards be used for washing milkers' hands and cows' teats and udders.

WHAT IS AN ACRE?

5 yards by 968 yards	contains 1 acre.
10 yards by 484 yards	contains 1 acre.
20 yards by 242 yards	contains 1 acre.
40 yards by 120 yards	contains 1 acre.
80 yards by 60½ yards	contains 1 acre.
70 yards by 68 1/9 yards	contains 1 acre.
220 feet by 198 feet	contains 1 acre.
440 feet by 99 feet	contains 1 acre.
369 feet by 110 feet	contains 1 acre.
726 feet by 60 feet	contains 1 acre.
363 feet by 120 feet	contains 1 acre.
240 feet by 180½ feet	contains 1 acre.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the Advanced Register of the Herd Books of the A.I.S. and Jersey Societies. Production records for which have been compiled during the month of February, 1946 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
SENIOR, 4 YEARS (STANDARD, 330 LB.).				
Sunnyview Velvet 3rd	J. Phillips, Wondai	11,880·4	492·923	Sunnyvale Monarch
SENIOR, 3 YEARS (STANDARD, 290 LB.).				
Yarranvale Model 2nd	W. Henschell, Yarranlea	7,984·58	327·999	Trevor Hill Bosca
SENIOR, 2 YEARS (STANDARD, 250 LB.).				
Valera Lila 11th	Sullivan Bros., Pittsworth	8,475·2	371·565	Alfa Vale Pride 2nd
Royston Myrtle	A. Lohse, Degilbo	6,715·0	257·736	Sunnyview Royal Chief
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Valera Nancy 2nd	D. Sullivan, Pittsworth	8,705·47	368·367	Alfa Vale Pride 2nd
Bingleigh Vision 3rd	J. C. Meier, Mount Mort	8,620·67	351·154	Blackland's Jeans Victory
Bingleigh Queenie 8th	J. C. Meier, Mount Mort	6,408·49	287·001	Blackland's Jeans Victory
JERSEY.				
MATURE COW (STANDARD, 350 LB.).				
Lernont Belarine	J. Schull, Oakey	9,071·65	475·246	Belgonia Lady's Duke 2nd
Kathleigh Brown Mist	F. W. Kath, Moffatt	8,292·68	446·556	Calton Larris
Westbrook Pearl	Farm Home for Boys, Westbrook	8,098·15	427·384	Oxford Asters Lad
Tralee Margaret	W. Muller, Marburg	6,870·52	390·304	Oxford Rivalli
SENIOR, 4 YEARS (STANDARD, 330 LB.).				
Kathleigh Whatnot	F. W. Kath, Moffatt	8,096·31	445·711	Calton Larris
Boree Coral	W. and C. E. Tudor, Branch Creek	6,941·75	349·136	Maurfield Larkspurs Gift

Senior, 3 Years (Standard, 290 lb.).				
Strathdean Coronation	S. H. Caldwell, Bell	7,429·86	434·709	Navua Ladoras Ruler
Strathdean Tiny	S. H. Caldwell, Bell	7,235·22	433·132	Strathdean Ambers Ruler
Lermont Heather Bell	J. Schull, Oakey	7,960·85	423·148	Lermont Ambassador
Strathdean Joyful Jean	S. H. Caldwell, Bell	7,020·21	398·232	Navua Ladoras Ruler
Boree Promise	W. and C. E. Tudor, Branch Creek	7,076·7	392·054	Maurfield Larkspurs Gift
Boree Princess Rose	W. and C. E. Tudor, Branch Creek	7,535·53	363·059	Maurfield Larkspurs Gift
Junior, 3 Years (Standard, 270 lb.).				
Ashview Tot	C. Huey, Sabine	7,243·55	338·346	Trecarne Victor 4th
Glenview Royal Glory (258 days)	W. Muller, Marburg	5,709·5	325·082	Trinity Royal Prince
Senior, 2 Years (Standard, 250 lb.).				
Romsey Ginger Girl	J. Wilton, Killarney	7,403·3	361·058	Oxford Pixies Victor
Boree Belle	W. and C. E. Tudor, Branch Creek	6,835·52	346·534	Maurfields Larkspurs Gift
Junior, 2 Years (Standard, 230 lb.).				
Blackland's Cream Flake	W. S. Conochie, Sherwood	7,000·25	397·336	Englorie Cunning Victor
Kathleigh Whisper	F. W. Kath, Moffatt	5,603·81	336·559	Oxford Daffodils Victor
Glenrandle Luna	P. Kerlin, Killarney	5,481·9	305·320	Bellgarth Stylish
Kathleigh Primrose (258 days)	F. W. Kath, Moffatt	5,597·36	302·842	Oxford Daffodils Victor
Romsey Brown Betty	J. Wilton, Killarney	5,288·2	297·008	Oxford Pixies Victor
Brookland's Merry Primula	W. S. Conochie, Sherwood	6,230·95	294·031	Bulby Maria Keepsake
Glenrandle Verabelle	P. Kerlin, Killarney	5,626·8	293·149	Bellgarth Stylish
Ashview Marvel	C. Huey, Sabine	4,213·9	242·960	Trecarne Victor 4th

"Swelled Head" of Sheep.

(Continued from February Issue.)

G. R. MOULE, Veterinary Officer, Sheep and Wool Branch.

SOME of the causes of the symptom commonly referred to as "swelled head" in sheep were described in the January and February issues of the Journal and the remaining three causes of this condition are described here.

BARBER'S POLE WORM INFESTATION.

The barber's pole worm is very common in coastal and subcoastal areas, and wherever sheep are depastured in such districts infestation is likely to occur. These worms are also common in some of the inland districts, notably in the forest country to the east of Aramac and Barcaldine, around Morven, and in the sheep areas east of this centre.

Seasonal Occurrence.

The barber's pole worm is particularly plentiful during wet summer conditions. Investigations conducted conjointly by the C.S.I.R. and the State Department of Agriculture in co-operation with certain graziers in Queensland have shown that the activity of the worm increases during the spring months and heavy infestations are likely to occur from that time until the autumn.

The Effect of Heavy Infestation.

The barber's pole worm sucks blood from the sheep, and when a heavy infestation develops the blood may become so impoverished that the sheep no longer thrives. When sudden massive infestations occur, such a large volume of blood is removed by the worms that swellings occur in the pendent parts under the jaw. This condition is usually referred to as "bottle jaw."

Symptoms.

The symptoms exhibited by a sheep suffering from barber's pole worm infestation are typical of those seen in diseases where the blood is impoverished. The animals become weak; they do not travel well, and on mustering they are inclined to drop out from the flock and refuse to move.

The membranes of the mouth and eye are pale and blanched and the skin is dull and lifeless.

"Bottle jaw" (Plate 91) usually develops. Sometimes the swelling extends down the neck and brisket to the front legs.

Plate 91.
"Bottle Jaw."—A typical symptom of "swelled head" caused by barber's pole worm infestation.

Post Mortem Examination.

On post mortem examination the swellings under the jaw are found to be clean and jelly like and are restricted to the tissues under the skin. The blood is thin and watery, and a large number of barber's pole worms is found in the fourth stomach.

Preventive Measures.

As increased activity on the part of the barber's pole worm can be expected during the spring months, it is as well to drench in late August or early September to prevent a large "worm burden" developing.

Subsequent drenchings should be planned in accordance with the occurrence of summer rains and should be co-ordinated as much as possible with rotational grazing and with mating programmes.

Treatment.

As a routine preventive drench against barber's pole worms, bluestone and arsenic or carbontetrachloride may be used. If a heavy infestation occurs and many sheep develop bottle jaw, it is advisable to use phenothiazine at half the usual dose rate—i.e., give a 10-gram dose instead of a 20-gram dose.

YELLOW BIG HEAD.

Yellow big head is the common name given to a condition in which there is a marked increase in the sensitivity of the skin to light. The symptoms shown are suggestive of very acute sunburn, and they are brought about as the result of certain substances circulating in the blood. These substances gain entrance to the blood stream after the sheep has eaten certain plants.

Symptoms.

As the occurrence of yellow big head is dependent upon the reaction of the skin to light, the parts most commonly affected are the unwoolled portions of face and sometimes those of the legs.

Initially the skin becomes reddened, and later thickened, particularly over the lips and ears. There may be a yellowish discharge from the eyes, the mucous membranes become yellowish, and the eyelids droop. Later the head and lips become quite swollen and the skin is dark in colour and dried like parchment. During the greater part of the time when animals are affected they are disinclined to eat and to move around and they usually seek the shade.

Course.

The course of the disease varies. Some animals die, but the majority recover slowly.

Plants Responsible.

Several plants have been incriminated as being capable of causing this condition, and included amongst these there are burr trefoil, bull-head, onion weed, and paddy-melon. However, there is some evidence to suggest that any sudden flush of green feed may set up the condition in sheep which have been on dry pastures.

Treatment.

There is little that can be done from the point of view of medicinal treatment. It is advisable to allow affected animals to rest in the shade. Where valuable stud sheep show the symptoms the unwoolled portions of the face could be protected from the sun by covering them with black soot.

BIG HEAD DUE TO EATING CAUSTIC CREEPER.

Caustic creeper or milk weed is a small herb-like plant which occurs extensively in Queensland. It is seen most commonly in the richer soils of the inland, and under certain circumstances hungry travelling sheep appear to be affected. There is considerable swelling of the head and neck, and if these are pierced a dark amber-coloured fluid exudes.

As the only real danger is with travelling sheep, care should be taken to see that heavy stands of this plant are avoided when the sheep are hungry.

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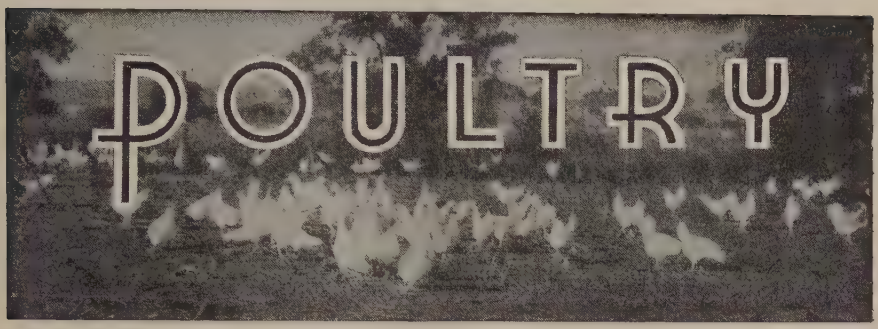


Eggs—Preserve Their Quality.

By P. RUMBALL, Officer in Charge, Poultry Branch.

EFFICIENCY in breeding, feeding, and general care of poultry with the object of obtaining the maximum production will not make poultry-raising a success unless similar care and attention are given to the product—eggs.

Although eggs from healthy stock and produced under the most suitable conditions are invariably uncontaminated within the shell, they are, under certain conditions, subject to bacterial and mould infection, and consequently may suffer deterioration from this source as well as deterioration due to heat and other causes. The fowl produces one of the most nutritious and wholesome forms of food for mankind, and it rests with the farmer, in the first place, to retain it in this form, and with every person handling eggs prior to their reaching the consumer to protect the egg from any form of deterioration.

The wholesale price of large eggs of first quality to-day is 2s. per dozen, whereas only 1s. 5d. is being paid for the same sized egg of second quality. On few farms does the percentage of first quality large eggs exceed 80 per cent. At certain periods of the year on some properties little more than 50 per cent. of first quality eggs are produced. Poultry raisers cannot afford to lose approximately 25 per cent. of the value of a large proportion of the product of their farms and remain in the industry. In addition to the financial loss incurred by the individual farmer who produces a large proportion of second quality eggs, there is the collective effect of the accumulation of large quantities of eggs upon the market, as they have a most depressing effect upon values and are most difficult to dispose of at prices commensurate with their cost of production.

The only outlets for Queensland eggs are the Australian and overseas markets. It is not economically sound to export any eggs other than those of first quality, and it is not reasonable to expect the Australian consumer to be satisfied with anything less than the overseas buyer.

STRUCTURE OF THE EGG.

A brief outline of the structure of the egg and the various causes of depreciation in quality, it is hoped, will make for better care in handling and for the acceptance of recommendations made with the object of maintaining quality.

The yolk is the first part of the egg to develop. This takes place in the ovary, where many hundreds of yolks are situated in various stages of development. Each yolk is enclosed in a sac which, when the yolk is mature, ruptures along the non-vascular area, releasing the yolk into the oviduct. Occasionally this rupture extends beyond the non-vascular area, causing bleeding from one of the small blood vessels of the yolk sac, with the result that the yolk is released with a clot of blood. The presence of blood with the yolk renders the egg unmarketable on account of its appearance. When a producer is faced with a high percentage of such eggs, he should examine the system of feeding. Over-stimulating foods are suggested as a probable cause: if an examination of the total ration supplied indicates that the protein content is in excess of 15 per cent., the ration should be altered to reduce the crude protein content to that level, such alteration having as its object the reduction of the incidence of eggs with blood spots.

The colour of the yolk is influenced by feeding, and may vary from that of a pale straw colour to a deep orange-red. The colour most sought after is that of a good golden yellow, and breeders who are producing pale yolks may improve colour by feeding yellow maize and green feed.

The yolk is enclosed in a membrane referred to as the vitelline membrane. On the surface of the yolk will be noticed a light circular area. This is the germinal disc. Around the yolk is a layer of thin albumen. This is enclosed in a denser layer of thick albumen which is twisted at each end, the twisted portion being known as the chalaza. Around this thick albumen there is an outer layer of thin albumen. Next comes the inner shell membrane, then the outer shell membrane; the shell is then laid on, not in its solid form as seen, but by the accumulation of lime salts in more or less a semi-liquid form which becomes hardened before the egg is laid. Naturally there are minute pores between the particles in the shell forming material. Nature then, as a further protection, coats the egg with a gelatinous material before it is laid. This last coating is frequently referred to as the "bloom" of the egg, and if the egg could be carefully collected from the hen when laid, and allowed to dry, one would have then the best possible product to handle, and if given the correct subsequent treatment there would be little cause for complaint as to quality. This, however, is not possible under commercial conditions, but it would be as well at the outset to realise that the less the removal of the protective coating the better is the keeping quality of the egg, and therefore the producer should do all in his power to maintain the egg in its nearest approach to that as laid and realise that until some protective medium is found which may be added to any fluid used for washing eggs, without detriment to the egg, such washing renders the egg more susceptible to deterioration.

FACTORS IN DETERIORATION.

The poultry raiser has three principal factors to give consideration to in the protection of the egg quality—

(*a*) Fertile eggs;

(*b*) Soiled eggs;

(*c*) The effect of heat upon the egg.

Fertile Eggs.

There are other influences to which eggs may be exposed which affect quality—namely, the attack of moulds and bacteria. These influences, however, are not common where the best possible conditions for production have been followed.

The production of fertile eggs should be avoided as far as possible. Although incubators are operated at a temperature of 100 deg. Fahr., it does not need a similar temperature to commence the development of the germ, and in the height of summer it is almost impossible on many of our farms to keep eggs at a sufficiently low temperature to prevent some form of cell division taking place with the fertile egg, and once embryonic development has advanced to any degree and stops, decomposition soon follows.

Under these circumstances, males should not be allowed to run with the flock, except during the period when breeding practices are in operation.

Soiled Eggs.

Nests.

The next condition to guard against is the soiling of eggs within the nests. Naturally an ample supply of clean nests, sufficiently roomy for the bird, should be provided. In these nests it is essential to have some form of material to make the nest comfortable and attractive to the bird, to protect the egg from being broken, and to protect the egg, as far as possible, from becoming soiled. Many egg producers use old-type butter boxes for nests. These are very suitable in size, and in planning any form of nests the butter box could be used as a guide for size. The big factor is to construct nests so that they are readily cleaned, and of material that is free from odours, as eggs readily absorb taints.

Various forms of nesting materials are used, such as straw, shavings, sawdust, sand, and shell-grit. Shavings and sawdust are very absorbent and not scratched out of the nest to the same extent as straw, and by reason of their fineness have a greater cleansing effect upon the feet of the birds, thereby preventing to some extent the soiling of eggs. If sawdust or shavings are used, pinewood residues should be chosen, as many of our hardwood sawdusts have a staining effect upon the shell of the egg. Shell grit is a reasonably good nesting material, but is naturally not so absorbent as sawdust and is too expensive in many districts for extensive use. Sand closely resembles shell grit, but many particles become attached to the moist gelatinous coating of the egg when it is laid and are most difficult to remove without washing.

Egg Collections.

It is not sufficient to provide suitable nests and nesting material. The frequency with which eggs are gathered has a very marked effect upon their cleanliness and more than that upon the labour entailed in preparing the eggs for market. Three gatherings per day is a practice that should be followed upon most farms, particularly during the period of the year when production is at its height and several birds are visiting each nest daily. When production is slack, generally in the cooler months, the gathering of eggs can be reduced to twice daily. Not only does the frequency with which eggs are gathered assist in keeping the eggs clean, but it protects also against breakages and the possible development of the vice of egg-eating.

Effect of Heat.

The egg, when manufactured, is full. Upon cooling, there is a separation between the two membranes within the shell of the egg, which creates a small air cell. Heat hastens the evaporation of the moisture contained in the egg, enlarging the air cell. The albumen becomes thinner. The yolk becomes more visible upon candling, and instead of being retained in a more or less central position of the egg becomes "sided" and at times attached to the shell. When this type of egg is broken for poaching or frying purposes the yolk is flatter, not standing up like a new laid egg or an egg which has not been subjected to heat, and the albumen spreads by virtue of its thinness. The consumer does not appreciate either of these conditions.

It does not require a very high temperature to cause this breaking down, and it has been found that a temperature over 60 deg. Fahr. is conducive to rapid deterioration of quality. In fact, temperatures of 68 deg. Fahr. have been known to stimulate embryonic development, therefore the coolest position upon the farm should be sought for the storage of eggs pending shipment to markets. Further protection of the egg against excessive heat is given by frequent gatherings, as it prevents their being reheated by visits of several other birds to the nests.

Eggs should be gathered in 2-gallon buckets with rigid sides. A bucket of this capacity will hold from 100 to 120 eggs, the bulk of which is conducive to the rapid loss of animal heat when placed in cool quarters. The nests should be erected in positions that are not exposed to the sun. For this reason nests extending in front of the poultry sheds are not recommended as most suitable for the preservation of quality. During transit to market cases of eggs should also receive some protection.

The storage of eggs on the farm pending shipment to market is most important. They should be held in a room which is as uniform in temperature as possible. One between 40 deg. and 60 deg. Fahr. would be ideal. It should be free from odours and have good ventilation. If the air is too dry the humidity may be increased by setting pans of water about the room or sprinkling the floor. Excessive moisture, however, should be guarded against. This is indicatd by condensation.

Moulds and Bacterial Infection.

Mould invasion of eggs is not uncommon in Queensland, particularly in the early part of the year when humid conditions prevail. Mould growths in several instances have been traced to the ordinary brown strawboard fillers frequently used, and on other occasions to nests in which mouldy grass or straw has been used for litter.

Humid conditions are conducive to the development of moulds, which enter the eggs through the pores of the shells, causing them to develop what are known as black rots. Protection is afforded by using in the nests only sweet and dry nesting material, by keeping the cases and fillers used for packing as dry as possible, and by never packing eggs that have moisture adhering to the shell.

Bacterial invasion of the egg is not uncommon, and in every instance that has been investigated the infection has extended only to those eggs that have been submitted to a cleansing process by washing. As previously mentioned, washing removes the protective coating placed on the shell by nature, and as it is a common practice to totally immerse

soiled eggs in water which has been polluted by hundreds of others, it will readily be understood how easy it is to convey harmful bacteria from one egg to another.

As a protection against bacterial invasion of the egg, as much as possible of the dirt and filth adhering should be scraped off with a knife while the egg is dry, the water used for washing purposes replenished at frequent intervals, and any cloths used in cleaning kept clean by frequent rinsings and, if the cloth is to be used from time to time, sterilized by boiling. In any cleansing process it may be necessary to remove stains with an abrasive. When such is necessary, some odourless material which is not of too coarse a nature should be selected.

Recently an experiment was conducted by the Missouri Agricultural Experiment Station by adding to the egg-washing water 1 per cent. of lye water as a protective against bacterial invasion. This experiment indicates that the problem of egg quality due to bacterial invasion is met elsewhere than in Queensland. The Missouri experiment appeared highly satisfactory, but in view of the caustic nature of the solution used it does not appear to be a practice that could be generally adopted, and it is only mentioned to indicate the need for the exercise of the greatest care in production and the desirability of reducing the need for washing until some suitable protective agent is found.

Packing.

The practice of using chaff, &c., for packing material fortunately has largely ceased, and the standard case and fillers adopted. Many producers, however, with the object of effecting greater protection to the egg, use chaff and material of a like nature in the bottom and frequently on the top of cases. This is not recommended. As well as causing the eggs to become dusty in appearance the practice exposes the egg to infection by moulds. If it is necessary to use some material to take up the slack in the case, crumpled paper is preferable.

The standard 30-dozen case, as now used by the Queensland Egg Board, is one that obviates the necessity for any further protection, and is definitely recommended to all producers as the best means of packing.

Summary.

Adherence to the following rules will ensure the production of quality eggs:—

(1) Breed only from birds that produce eggs of satisfactory size and shape and good-quality shell.

(2) Provide only wholesome food, including shell grit and fresh water. Remember that yolk colour is improved by the feeding of green feed and yellow maize.

(3) Produce infertile eggs for market, thereby preventing them from decay due to partial embryonic development.

(4) Provide at least one nest and clean nesting material for each five layers. Keep the nests dry and protected from the sun.

(5) Do not allow broody hens to occupy nests. They heat up the eggs.

(6) Gather eggs in a clean bucket thrice daily in summer and twice in winter, and stand in a cool place until animal heat is lost before packing.

(7) Do not wash eggs unless it is absolutely necessary to do so to make them thoroughly clean. Aim at keeping them clean by good management.

(8) Keep eggs until marketed in a cool, clean room free from odours.

(9) Market eggs at least twice weekly, protecting them from the sun during transit.

(10) Use only standard cases and fillers for packing.

THE FUTURE FARMERS OF AUSTRALIA.

As in other States of the Commonwealth, the junior farmers' movement is a live issue in Queensland, although, up to the present, attention has been concentrated on the development of home project clubs in schools, especially in country districts. It is suggested that there is need for extending the movement to include boys and girls who have left school along the lines of the junior farmers' clubs in the southern States and which have taken firm root in many rural communities. As an outstanding agricultural educational movement, the junior farmers' clubs in the South are doing an excellent national work. They are already showing how to produce crops and breed and feed farm animals at less cost, how to conserve soil and its fertility and to lay foundations of future agricultural prosperity. This junior farmers' club movement aims at building better farms, better homes and better citizenship.

To some extent, the Australian Junior Farmers' Club Movement compares with the Future Farmers of America National Organization of, by and for farm boys studying vocational agriculture in public secondary schools. The major purposes of that organization are to develop agricultural leadership, co-operation, citizenship, improved agriculture and patriotism. It is now recognized as the largest farm boy organization in the world. On their home farms the boys and girls put into practice the principles of farming in all its branches. They have established the beginnings of quality beef and dairy herds, and apply improved practices in crop production. Above all, they are proud of the fact that they are farmers and that farming is their chosen life vocation. This, briefly, is their creed:—

A belief in the future of farming, with a faith born not of words but of deeds—achievements won by the present and past generations of farmers; in the promise of better days through better ways.

A belief that to live and work on a good farm is pleasant as well as challenging, a belief based on an inborn fondness for country life and its associations. A belief in leadership from themselves and respect from others.

A belief in their own ability to work efficiently and think clearly, with such knowledge and skill as they can attain, and in the ability of organized farmers to serve their own and the public interest in marketing of their own products.

A belief in less dependence on begging and more power in bargaining; in the life abundant and enough honest wealth to help make it so—for others as well as themselves; a belief in less need for charity and more of it when needed; in being happy themselves and playing square with those whose happiness depends on them.

A belief that country life and industry can and will hold true to the best traditions of national life.

That is the creed of the future farmers of America, and, although expressed a little less colourfully perhaps, it is the creed of the future farmers of Australia—members of the Junior Farmers' Club Movement in Victoria and New South Wales, which, no doubt, will spread to other States.

The main object of the Junior Farmers' Club Movement is to keep farmers' sons and daughters on the land and, through vocational agriculture, enable them to develop the ability to become successfully established in farming for themselves. "Learning to do; doing to learn; earning to live; living to serve"—that is their motto.

GENERAL NOTES

Staff Changes and Appointments.

Mr. D. N. Sutherland, B.V.Sc., has been appointed Veterinary Officer, Division of Animal Industry.

Mr. A. F. S. Ohman, Divisional Veterinary Officer in the Department of Agriculture and Stock, has tendered his resignation.

Mr. J. L. Schofield, Agrostologist, has resigned from the Department.

Mr. C. G. Williams, Adviser in Horticulture, has been appointed Supervisor (Preparation and Transport), Horticulture Branch, Department of Agriculture and Stock.

Mr. K. King, Adviser in Horticulture, has been appointed Senior Adviser, Horticulture Branch, with headquarters at Rockhampton.

Butter Concentrate.

Orders in Council have been issued authorising the Queensland Butter Board to engage in the production of dehydrated butter and/or butter concentrate in lieu of tropical butterfat spread. During the war years, the Board produced quantities of tropical butterfat-spread for the use of *Field Forces* in tropical areas. The product was developed and improved from time to time until, finally, a dehydrated butter which will keep without refrigeration for considerable periods was produced. This product is known as butter concentrate.

Queensland Dairymen's Organization.

In November, 1945, the provisions of *Section 30* of *The Primary Producers' Organisation and Marketing Acts* were extended to the dairying industry by *Order in Council*, in which provision was made therein for a field organization for the dairying industry consisting of local dairymen's committees, district dairymen's councils, and the Queensland Dairymen's State Council.

Regulations, known as *The Dairymen's State and District Councils Regulations of* 1946, have been issued to define the procedure to be followed in the conduct of the initial elections of the nine district dairymen's councils, and the convening of the first meetings of such councils and of the Queensland Dairymen's State Council.

The dairymen in each of the nine districts specified in the *Order in Council* of November, 1945, will elect seven members to each district dairymen's council. After the elections, each district dairymen's council, at its first meeting, will choose one of its number as a member of the Queensland Dairymen's State Council. The organisation will then proceed to function in accordance with the provisions of the *Order in Council* of November, 1945.

Veterinary Science Scholarships.

Following the institution of veterinary science scholarships last year to provide for veterinary staff requirements of the Division of Animal Industry, Department of Agriculture and Stock, it has been announced that three scholarships have been allotted for 1946 to Messrs. R. J. Olds (Fairfield), G. I. Alexander (Charters Towers), and D. F. Mahoney (Yengarie). The scholarships cover a period of five years, the first year of the course to be taken at the University of Queensland, and the remainder at the Sydney University.

In addition to these scholarships, certain officers of the Department have been granted the necessary leave of absence to enable them to take a full-time course in veterinary science under the Post-War Reconstruction Training Scheme.

Northern Pig Board.

An Order in Council has been issued under *The Primary Producers' Organisation and Marketing Acts* extending the operations of such Acts to pig carcasses grown within the area of the Northern Pig Board, and placing such pig carcasses under the control of the Board. Previously, the *Acts* applied only to live pigs reared within the area.

Rural Topics

Food by Air.

Will transport aircraft be used to any great extent in future food deliveries is a question which has come up since it was seen how effective air transport of perishable foods was during the war. A regular food supply service was maintained between Australia and advanced Army areas in New Guinea and elsewhere. On some runs, fresh beef was transported by air daily; and other fresh foods also were sent regularly to forces in the field. "Biscuit bombers" were always a welcome sight to Diggers on patrol. Then, again, there was the fresh fish delivery service between points on the Gulf of Carpentaria and some inland centres.

The question of how far air transport will affect the marketing of foodstuffs generally also is of interest to primary producers. Yet the practical side of air-borne food delivery depends on how much such a service adds to the delivered cost, and whether consignees would be willing to pay the difference. Anticipated (or estimated) ton-mile rates by air are considerably higher than by rail or road, but the shorter air distances from point to point might reduce the difference in freight cost. Other factors have to be considered, of course. Take fruit, for instance. What effect would changes in air pressure which occur during flight have on the fruit? All factors require study, but practical economies from lighter packages of air-borne fruits and vegetables are considered probable; also savings in cold storage en route. The range and speed of modern aircraft now make it possible to deliver today's tree-ripened fruits on tomorrow's markets anywhere in the country.

However, it all adds up to a total of cost and its comparison with other transport systems. Yet, regular food delivery by air on an economical basis seems well within the realm of practicability, and it certainly has an interest for the primary producer, even though at present it may be only a speculative interest. "Biscuit bombers" routed regularly on radio beams will, one day, assuredly be accepted as a normal transport service.

Working for a Better World.

Whatever may be the outcome eventually of present world movements for a better agriculture, it is good to feel that some progress is being made in the world-wide quest for peace and security. At the recent conference of the Food and Agriculture Organisation in Canada, at which Australian producers were represented, an entirely new doctrine in human relations was evolved. This new concept envisions a day when there will be plenty rather than scarcity, when there will be co-operation instead of cut-throat competition which depresses standards of living and leads eventually to war. The new school champions an expanding economy and advocates co-operation between sellers and buyers in order to adjust production to consumer needs and thus avoid fanatical price-cutting and ruinous competition.

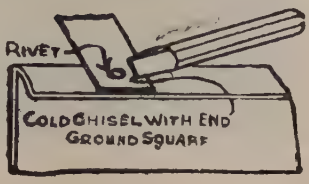
For generations we have been learning all the tricks in an economy of scarcity. It may require another generation or two to learn how to manage and enjoy an economy of plenty.

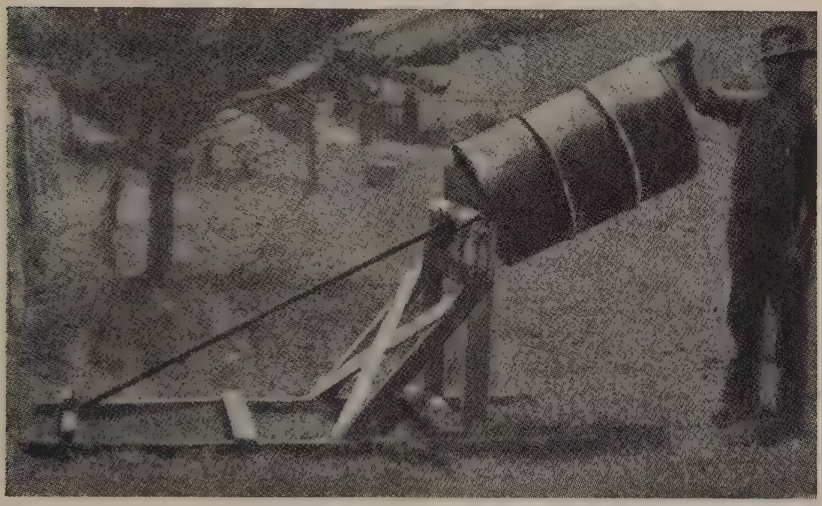
The International Food and Agriculture Organization supports this new doctrine and aims to attain a co-ordinated balance in food output among the primary producing countries of the world.

GADGETS AND WRINKLES

SHEAR CUTS FOR RIVETS.

The best way for cutting off rivets is to shear them off with a square end chisel rather than cut them with a sharp edge. This is the method used by most wreckers in tearing up car frames.





AN IMPROVISED CONCRETE MIXER.

Where farmers have some seasonal concreting to do the improvised mixer illustrated will be of great assistance in reducing the amount of manual work. The construction of the mixer can be fairly readily seen from the photograph, most of the materials used being quite plainly shown; the main essentials are an oil drum, some timber, and a piece of 1-in. piping about 10 ft. long.

The piping passes through a neat hole at each end, and just outside the drum at each end a pin should be inserted in the pipe to prevent the drum from sliding. Immediately below the drum the piping should be supported by bearings between the upright timbers, while the end of the piping should be held down to prevent the drum from tipping during mixing, and yet to permit of easy rotation in working.

The drum requires to have nearly half the top cut away for filling and emptying, and a handle fitted near the outer edge to allow the drum to be rotated by hand during mixing.

As material is mixed the drum can be emptied by releasing the foot of the piping, and using the piping as a lever to direct and regulate the flow of the mix.

The mixer illustrated was seen in use on Mr. W. Sanderson's farm at Kaitoke, Great Barrier Island.—C. Walker, Instructor in Agriculture, Thames, in the *New Zealand Journal of Agriculture.*

Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

HOW MOTHERS AND CHILDREN CAN OBTAIN THEIR VITAMINS.

THE Sister at one of the welfare centres was advising a grandmother who was taking care of her deceased daughter's baby. The baby was four weeks old and the sister said that he must now have some strained orange or other fresh fruit juice added to his diet in order to provide him with vitamin C, which is lacking in the food of bottle-fed infants. The grandmother looked rather scornful. "I don't care much for these new fangled ideas," she said, "no one bothered about vitamins when my children were little and there's nothing much wrong with them." The sister remembered that the baby had an uncle who had returned from a Japanese prison camp suffering from a disease known as beri-beri, and so she enquired how he was. The grandmother brightened up as she related the marvellous improvement in his condition week by week. "Do you know what is curing him?" said the sister, "vitamins." After further explanation the grandmother was more than willing to start the baby on his fruit juice at once.

Vitamins are not a new fangled idea. They are chemical substances which occur and always have occurred in all natural *whole* foods and each has its own work to perform in keeping the body healthy. Because our soldiers who were prisoners of war did not have enough food and the food they had was mostly white or polished rice, many of them developed what are known as deficiency diseases caused by the absence of these important vitamins from their food. Their condition would have been much worse in many cases if doctors and others who were imprisoned with them had not known about vitamins and tried to obtain them from shrubs and other herbage which they found in the bush.

Everyone needs a good supply of each vitamin in order to remain physically fit and able to resist infections, but expectant and nursing mothers and growing children need an extra supply and great care should be taken to see that they get them. For convenience, the vitamins are known by the letters of the alphabet, and it is important that people in charge of mothers and children and also the mothers themselves should know the vitamin-containing foods.

There are several vitamins, but only four are likely to be deficient in Australian diets. They are:—

Vitamin A.—This is found in cod liver oil and other fish oils, also in butter, egg yolk, milk, cream, liver and green and yellow vegetables and fruits. This vitamin is necessary for children's growth, and also helps them to resist illness as well as preventing certain forms of eye trouble.

*Vitamin B*1.—This is found in *whole grain* cereals, marmite and vegemite, eggs, and seeds such as peas, beans and nuts. This vitamin is necessary for normal appetite, good digestion, prevention of constipation, and the disease of the nervous system, known as beri-beri. That is why it is so necessary for people to eat oatmeal or wheatmeal porridge and whole-wheat bread.

Vitamin C.—This is found in good quantity in oranges and other citrus fruits, tomatoes, papaws and pineapples. A small amount is in uncooked vegetables. If fruit is not available or is too expensive for the family budget, vitamin C for the baby may be obtained by extracting the juice from raw carrots, potatoes or swede turnips. Foods containing vitamin C tend to prevent dental decay, infections, anaemia and the disease known as scurvy.

Vitamin D.—This is present chiefly in cod and other fish liver oils, in the liver of animals, and in tinned salmon and herrings. Some is present in butter and egg yolk. Unlike all other vitamins it can be formed in the body by exposing the skin to direct sunlight. That is why mothers and babies must have sun baths. Vitamin D helps to build sturdy, vigorous children with strong bones, straight active limbs and good teeth.

Any further advice about this or any other matter can be obtained by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 *St. Paul's Terrace, Brisbane*, or by addressing letters, *Baby Clinic, Brisbane*. These letters need not be stamped.

IN THE FARM KITCHEN.

For the Colder Weather.

Baked Meat Pudding.

This is an excellent way to use up any left-overs:—Requirements: 1 lb. cold meat (minced); 1 thick slice bread soaked in milk or stock; 2 small onions; 1 level tablespoon curry powder; juice of one lemon; 2 tablespoons sultanas; 1 beaten egg; 1 cup milk; a little good dripping; pepper and salt to taste.

Fry the onion in dripping and brown. Add all the ingredients except the egg and milk. Place in a fireproof dish, pour over egg and milk mixed together, then dot with a little good dripping and bake in a moderate oven for 25 minutes.

Pumpkin Pie.

Requirements.—1 tin condensed milk or a little less, according to taste; ¼ cup lemon juice; 2 cups mashed dry pumpkin; 1 teaspoon nutmeg; ½ teaspoon ground ginger; 1 teaspoon ground cinnamon; a pinch of salt; 1 cup sultanas or currants; short crust.

Add lemon juice to the condensed milk and beat until it thickens. Add the remaining ingredients and fill a tart plate lined with a good short crust. It may be cooked as an open tart or covered with strips of pastry formed lattice fashion. Bake in a hot oven for 10 minutes, then lower the heat and cook for about 20 minutes longer.

Different Ways of Serving Cauliflowers.

(1) After steaming or boiling the cauliflower in the usual way, shake over it fried breadcrumbs. To prepare these melt some butter about half an ounce, in a frying pan. When it has ceased to bubble sprinkle in some fine soft crumbs. Fry till lightly browned, shaking them about frequently while cooking. Season them with salt and pepper.

(2) Cover the cooked cauliflower with a rich white sauce. Over this shake grated nutmeg.

(3) Instead of the usual white sauce, cover the cauliflower with a tomato sauce made as follows:—Cut up roughly one pound of tomatoes. Put into a saucepan with a tablespoon of water and salt and pepper to taste. Cover the pan and bring slowly to the boil. Simmer gently, mashing down the tomatoes once or twice to extract as much juice as possible. Simmer for about ten minutes. Strain and press the pulp through a sieve. Measure and when cool make up to a cupful with cream or creamy milk. Melt one ounce of butter in a saucepan. Remove from the fire and add three-quarters of an ounce of flour. Blend smoothly with a wooden spoon. Gradually stir in the tomato and cream mixture. Return to the fire and stir till the sauce boils. Boil and stir for three minutes. Add a bare teaspoon of Worcester sauce. Mix and pour over the hot cauliflower.

QUEENSLAND WEATHER IN FEBRUARY.

Over average aggregate district rainfalls were recorded in the Peninsula, Carpentaria, North Coast, and adjacent Central Coast West districts, and were the result of the heavy to local flood totals registered mainly during two periods, 9th/12th and 14th 16th. Monthly totals included—Peninsula, Cape York, 1,855 points; Moreton, 1,383; Laura, 1,328; Walsh, 1,320; Lower Carpentaria, Burketown, 1,850; Cloncurry, 981; Normanton, 1,029; Kamileroi, 993; Upper Carpentaria, Lyndhurst, 1,762; Einasleigh, 1,103; Mt. Surprise, 1,035. In the North Coast Barron, falls ranged from 773 points at Chillagoe to 2,204 at Mossman; North Coast Herbert, 858 Clarke River to 5,510 Tully; Central Coast, Giru 1,477 points. A number of over 10-in. totals in the Central Coast East included 1,608 points Mingela, 1,868 Reid River, and 1,852 Woodstock, and the Central Coast West averaged 6 to 7 in. In the East Darling Downs and Moreton districts over average areas received storms early and late in the month, and several over 10-in. monthly totals in the latter Division included 3,849 points Springbrook, 1,219 Tallebudgera, and 1,256 Mapleton. In many Port Curtis sections, however, the run of dry or well under average rainfall months continued with February 64 per cent. below average. The main pastoral areas of the Central, Central-West, and Southern interior of the State missed the rains which passed westward through the Carpentaria to the Northern Territory and ultimately south through Central Australia to the south-eastern States. District averages of from 21 points in the South-West to 147 in the Central Lowlands were less than half normal, and continuance of seasonal tropical influences during March with a widespread soaking rain would do much to restore the dry South-West areas and consolidate winter pasturing conditions generally.

Floods.—Condamine River and *Southern Border streams* were still carrying run-off from late January rains, and local flooding was caused in the lower reaches early in the month from 2nd to 11th. At Surat, the Balonne River reached a height of 25 ft. 5 in. on the 6th. At Dirranbandi the Balonne Minor reached a height of 11 ft. 9 in.—3 ft. 9 in. above local level. At Condamine 22 ft. 6 in.—6 ft. above local flooding. *Burdekin.*—Two periods of minor flooding occurred on the northern Burdekin catchment, which later extended to lower Burdekin—viz., 10th to 16th and 22nd to 24th. Maximum heights reported were at bridge 9 ft. 8 in. over rails on 12th and 3 ft. 10 in. over rails on 22nd. Sellheim 28 ft. 6 in. on 11th, 28 ft. 9 in. on 20th. From 10th to 16th and 22nd to 24th flooding also occurred on upper headwaters of Gilbert and other Carpentaria streams. Einasleigh reported the Einasleigh River 6 ft. over rails on three occasions—12th, 16th, and 21st. There was also considerable local flooding in Central Coast low-lying areas and shorter river basins.

Temperatures.—Maximum temperatures varied from minus 4.1 deg. at Boulia, 2.3 deg. Cloncurry, 1.4 deg. Georgetown, to 3.8 deg. above normal at Mitchell. Several were about normal. Minimum averages were mostly above normal, and ranged from 1.6 deg. below at Palmerville to 4.5 deg. above at Mitchell. Thargomindah reported 110 deg. (2nd), and Windorah over 100 deg. on 17 days, Quilpie 20 (12 consecutive, 6th to 17th).

Brisbane.—Temperatures, mean maximum 84.8 deg., normal 84.4 deg.; mean minimum 71.0 deg., normal 68.6 deg.; mean temperature 77.9 deg., normal 76.6 deg.; highest daily 93.8 deg. on 20th; lowest daily 66.8 deg. on 24th. Rainfall, 732 points on 17 days, average 623 on 13 days. Sunshine, 189.8 hours, normal 205.7 hours. Maximum wind gust 41 miles per hour from south on 28th.

The rain position is summarised below—

Division.	Normal Mean.	Mean February, 1946.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	1,308	1,358	4 above
Peninsula South	896	1,109	24 "
Lower Carpentaria	617	833	35 "
Upper Carpentaria	556	674	21 "
North East, Barron	1,288	1,564	21 "
North Coast, Herbert	1,477	1,970	33 "
Central Coast, East	792	651	18 below
Central Coast, West	475	735	55 above
Central Highlands	351	178	49 below
Central Lowlands	310	147	53 "
Upper Western	304	307	1 above
Lower Western	195	91	53 below
South Coast, Port Curtis	576	209	64 "
South Coast, Moreton	658	620	6 "
Darling Downs, East	304	213	30 "
Darling Downs, West	233	165	29 "
Maranoa	282	91	68 "
Warrego	209	117	44 "
Far South-West	165	21	87 "

QUEENSLAND WEATHER IN MARCH.

The only districts showing over average aggregate rain totals were the North Coast Herbert, Central Coast East and West, and the South Coast Moreton. Heavy flood rains in these areas were the result of two cyclones, one during the first week affecting the tropical coast and adjacent highlands and the second in the third week the Moreton areas. Both distributions missed the Port Curtis section where patchy rains of 37 per cent. below normal maintained the unusually protracted dry spell for that part of the State. The Darling Downs East and Central Highlands received under average aggregate totals of 223 and 160 points respectively, but the greater part of inland Queensland was unusually dry for March, and many districts, especially in the western half, *reported no rain.* Previous seasonal rains during January benefited the whole of the State, and most of the tropical interior fared well in February. In the Central-West and most of the subtropical interior, however, *the absence of rain in March* was preceded by a dry February and the 3 to 4 inch falls of January in the south-west quarter and southern interior border districts will need to be supplemented by an early general soaking fall to ensure reasonable winter and spring pastoral conditions. Apart from the dry sections in the Port Curtis and adjacent inland areas, agricultural and pastoral conditions are generally good in the south-east quarter.

Flooding.—Under cyclonic influences extensive *heavy to record flooding* occurred during the first part of the month in all tropical coast streams between Cooktown and Rockhampton back to the adjacent highlands and east Carpentaria. Widespread damage, soil erosion, protracted traffic disabilities, were reported. There was some loss of life and the town of Home Hill was out of communication for a couple of days. The Burdekin River flooded from all catchment areas with *record heights.* Inkerman Bridge water 24 *feet* over bridge 9 a.m., 4th (previous height 14 feet—14th March, 1945). Sellheim gauge 70 feet 6 inches (5.30 a.m., 4th), previous height 63 feet 7 inches (12th March, 1927). Lornsleigh (Suttor River) 35 feet (7th), previous height 40 feet (23rd February, 1944). *Einasleigh Bridge* 9 feet over rails (4th). Townsville and Mackay also suffered considerable damage. Some heavy rain totals for the period 1st to 6th included on the inland edge of the storm area—578 points Irvinebank, 712 Clarke River, 740 Balfes Creek, 764 Mount Coolon, 526 Twin Hills, 453 Clermont. Near the coast 12 to over 20-inch amounts were general—2,073 points Babinda, 2,139 Tully, 2,684 Giru, 2,619 Calen, 2,440 Finch Hatton. A private observer reported 26 inches in 21 hours of rain on the Upper Ross River, 30 miles from Townsville. *Twelve inches between 3 a.m. and 5 a.m.*, 3rd March. The Moreton district flooding, also from cyclonic influences, was more of the local type form, as rains eased in time to prevent heavy general stream rises which occurred in the Northern Rivers of New South Wales. Heavy two-day falls, 24th-25th, included many 10 to 15-inch amounts—Bald Knob 1,885 points, Maleny 1,592, Mount Tamborine 1,797, Springbrook 2,509, of which 25 *inches* fell in 26 hours, 9 a.m., 24th, to 11 a.m., 25th (four-day total—3,677 points).

Temperatures.—Maximum temperatures in the south-west quarter ranged from normal at Mitchell to 3.4 degrees below at Thargomindah and Boulia. Other districts showed Longreach 1.2 degrees above to 3.2 degrees at Palmerville. Minimum readings varied from slightly below to 3.8 degrees Mitchell and 4.5 degrees Thargomindah. Days over 100 degrees—Longreach 5, Boulia 4, with 103 degrees highest reading at both places.

Frosts.—Some very early light local frosts—Bybera (2), 13th (39 degrees/26 degrees), 18th (40/29 degrees), Stanthorpe 3, minimum readings 37 degrees/31 degrees (13th), and 28 degrees and 30 degrees on grass (27th and 28th).

Brisbane.—Pressure 9 + 3 29.811 inches (normal 29.966 inches), lowest since 29.802 inches in 1892. Minimum barometer reading at 1510 hours (25th) 29.211 inches (second lowest on record—29.207 inches on 12th March, 1891). Temperatures—mean maximum 82.4 degrees (normal 82.2 degrees), mean minimum 65.9 degrees (normal 66.4 degrees), mean temperature 74.1 degrees (normal 74.3 degrees). Highest daily 93.8 degrees (10th), lowest daily 55.6 degrees (28th). Rainfall—834 points (16 days)—average 562 points (15 days). 406 points on 25th, highest since 499 points on 15th March, 1939. Highest wind gust—46 m.p.h. from south-west at 1355 hours 25th.

The rainfall position is summarised below:—

Division.	Normal Mean.	Mean March, 1946.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	1,219	491	60 below
Peninsula South	687	253	63 ,,
Lower Carpentaria	398	3	99 ,,
Upper Carpentaria	344	146	58 ,,
North Coast, Barron	1,379	669	51 ,,
North Coast, Herbert	1,390	1,679	21 above
Central Coast, East	603	1,127	87 ,,
Central Coast, West	345	868	152 ,,
Central Highlands	279	160	43 below
Central Lowlands	239	67	82 ,,
Upper Western	197	3	98 ,,
Lower Western	161	21	87 ,,
South Coast, Port Curtis	427	267	37 ,,
South Coast, Moreton	637	975	53 above
Darling Downs, East	277	223	19 below
Darling Downs, West	232	39	83 ,,
Maranoa	263	20	92 ,,
Warrego	193	24	88 ,,
Far South-West	133	7	95 ,,

Commonwealth of Australia,
Meteorological Bureau, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

MAY.

Supplied by the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	11	46	Longreach	28	42
6	6.16	5.13	Charleville	26	28	Quilpie	36	34
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	30	28	Roma	16	18
21	6.24	5.04	Dirranbandi ..	21	17	Townsville	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
31	6.29	5.00	Hughenden ..	23	47	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	a.m.	p.m.
1	5.27	5.14
2	6.36	5·57
3	7.46	6.45
4	8·56	7.40
5	10.04	8.39
6	11.06	9.41
	p.m.	
7	2.01	10.44
8	12.49	11.46
9	1.30	..
		a.m.
10	2.06	12.45
11	2.39	1.42
12	3.10	2.36
13	3.40	3.30
14	4.11	4.22
15	4.33	5.15
16	5.17	6.08
17	5·55	7.01
18	6.36	7.55
19	7.22	8.49
20	8.12	9.41
21	9.06	10.31
22	10.02	11.16
23	11.01	11.58
		p.m.
24	..	12.38
	a.m.	
25	12.01	1.15
26	1.00	1.51
27	2.01	2.27
28	3.05	3.05
29	4.11	3.45
30	5.21	4.31
31	6.32	5.23

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	16	23	32	39	8	14	36	45
6	10	29	26	44	0	19	28	52
11	16	23	32	39	8	14	36	44
16	25	13	42	29	17	3	49	32
21	29	11	44	25	19	0	52	28
26	22	17	38	33	13	8	44	37
31	12	28	27	43	2	19	30	51

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	38	46	56	30	41	20	33
3	11	48	38	62	23	48	11	40
5	6	52	36	65	20	50	7	44
7	7	49	36	63	21	49	8	41
9	13	42	40	58	25	44	14	35
11	22	37	46	56	30	41	20	32
13	31	28	52	49	36	34	26	24
15	41	18	57	43	42	28	34	17
17	48	10	63	38	48	23	40	11
19	53	5	67	34	50	20	44	7
21	52	5	66	34	50	20	43	7
23	46	9	61	37	46	23	37	10
25	41	18	57	43	42	28	34	17
27	30	30	51	50	35	35	25	25
29	19	41	44	58	29	43	18	34
31	9	48	37	62	22	48	9	40

PHASES OF THE MOON.

New Moon, May 1st, 11.16 p.m.; First Quarter, May 8th, 3.13 p.m.; Full Moon, May 16th, 12.52 p.m.; Last Quarter, May 24th, 2.02 p.m.; New Moon, May 31st, 6.49 a.m.

On May 16th, the sun will rise and set twenty degrees north of true east and true west, respectively; and on May 12th and 27th, the moon will rise and set at true east and true west, respectively

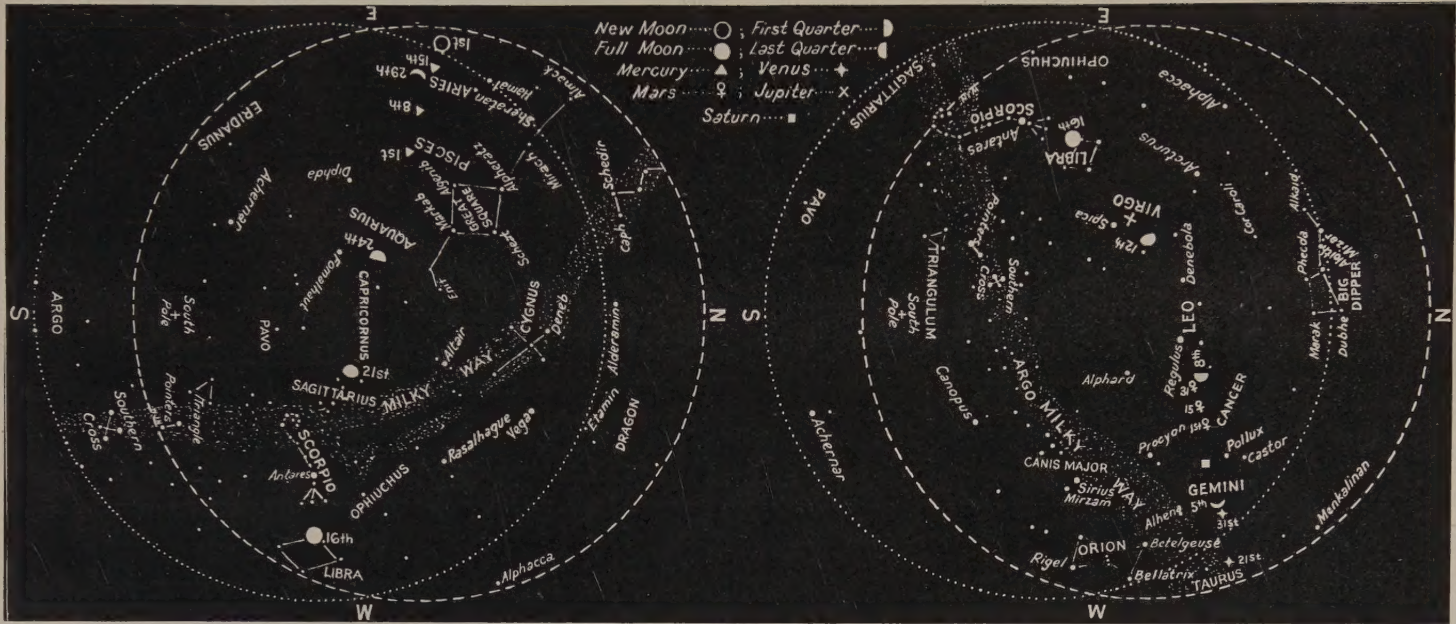
Mercury.—At the beginning of the month will rise about 2 hours before sunrise and at the end of the month will rise about sunrise and set at sunset, being in line with the sun on the 31st.

Venus.—May be seen in the western evening sky. At the beginning of the month it will set between 6.30 p.m. and 7.30 p.m., and at the end of the month between 7 p.m. and 8 p.m.

Mars—Will be observable in the western evening sky, setting just before midnight at the beginning of the month and between 10 p.m. and 11 p.m. at the end of the month.

Jupiter.—Rising about an hour before sunset at the beginning of the month, will be observable in the eastern evening sky. At the end of the month it will set between 2.30 a.m. and 3.30 a.m.

Saturn.—At the beginning of the month will set between 10 p.m. and 11 p.m. and at the



Star Charts.—Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving from east to west, arrive at any chosen position about 4 minutes earlier each night. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked dates. When no date is marked the position is for the middle of the month. When facing north hold N at bottom, when facing south hold S at bottom, and similarly for the other directions.

The chart on the right is as the stars will appear at 7.15 p.m. in the S.E. corner of Queensland at 8.15 p.m. along the Northern Territory border on May 15th. The chart at the left is for 10 hours later. On each chart the dashed circle is the horizon at Cape York, and the dotted circle is the horizon along the Southern Queensland border.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

MARCH RAINFALL.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of years' records.	Mar., 1945.	Mar., 1946.		Mar.	No. of years' records.	Mar., 1945.	Mar., 1946.
North Coast.	In.		In.	In.	*South Coast—cont'd.*	In.		In.	In.
Atherton	9·08	42	23·32	10·61	Gatton College	3·33	44	0·46	..
Cairns	18·16	61	48·69	7·37	Gayndah	3·10	72	0·78	0·99
Cardwell	15·77	71	41·96	19·73	Gympie	6·13	73	3·00	7·83
Cooktown	15·28	67	28·96	4·14	Kilkivan	3·90	62	1·92	3·39
Herberton	7·93	57	16·33	8·56	Maryborough	5·90	72	3·41	7·30
Ingham	15·99	51	39·85	20·17	Nambour	9·41	47	5·18	22·11
Innisfail	26·81	62	64·98	20·17	Nanango	3·42	61	0·41	4·30
Mossman	18·75	19	54·17	4·91	Rockhampton	4·48	72	1·28	4·40
Townsville	7·11	72	16·91	16·77	Woodford	7·90	55	2·80	15·81
Central Coast.					*Darling Downs.*				
Ayr	6·37	56	15·60	13·15	Dalby	2·74	73	0·54	1·04
Bowen	5·74	72	14·98	13·66	Emu Vale	2·47	47	0·20	3·27
Charters Towers	3·71	61	7·46	7·35	Jimbour	2·43	64	1·05	0·89
Mackay	12·09	72	13·47	20·04	Miles	2·74	58	0·34	0·32
Proserpine	12·17	40	20·78	16·73	Stanthorpe	2·59	70	0·27	2·58
St. Lawrence	5·41	72	2·55	7·09	Toowoomba	3·78	71	0·65	4·21
South Coast.					Warwick	2·60	78	0·46	3·61
Biggenden	3·98	44	1·01	2·34	*Maranoa.*				
Bundaberg	5·35	60	0·78	4·82	Roma	2·72	69	0·11	Nil
Brisbane Bureau	5·62	94	1·29	8·34	St. George	2·15	62	0·03	0·68
Caboolture	7·83	67	3·93	15·16					
Childers	4·84	48	1·10	3·80	*Central Highlands.*				
Crohamhurst	11·12	50	4·28	21·97	Clermont	3·16	72	0·50	4·55
Esk	4·72	56	0·91	6·43	Springsure	2·97	74	0·45	2·27

CLIMATOLOGICAL TABLE FOR MARCH.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric pressure Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Pts.	
Cairns	..	90	73	99	25	67	27	737	7
Herberton	..	83	62	91	11	54	27	856	8
Townsville	..	89	73	98	24	68	25,27,30	1677	7
Rockhampton	29·87	89	69	97	25	64	7		
Brisbane	29·88	82	66	94	9	56	28	834	16
Darling Downs.									
Dalby	..	84	59	93	10	42	27	104	6
Stanthorpe	..	76	53	85	10	37	13,27,28	258	7
Toowoomba	..	78	57	88	10	42	28	421	8
Mid-Interior.									
Georgetown	29·83	95	68	..	..	59	27	2	1
Longreach	29·83	95	67	103	9, 10	51	17	Nil	
Mitchell	29·95	87	58	95	10	43	27,28,29	20	1
Western.									
Burketown	..	96	72	105	23	59	27	17	1
Boulia	29·88	92	67	103	22	53	26	48	1
Thargomindah	29·95	88	63	99	7	49	26, 27	Nil	

A. S. RICHARDS, Divisional Meteorologist.

Commonwealth of Australia,
Meteorological Bureau, Brisbane.